

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
4 July 2002 (04.07.2002)

PCT

(10) International Publication Number
WO 02/051837 A2

(51) International Patent Classification⁷: **C07D 403/04**,
401/04, 471/04, A61P 25/00, A61K 31/435, 31/44, 31/40
// (C07D 403/04, 209:00, 207:00) (C07D 401/04, 211:00,
209:00) (C07D 471/04, 223:00, 209:00)

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(21) International Application Number: **PCT/US01/47935**

(22) International Filing Date:
11 December 2001 (11.12.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/257,627 22 December 2000 (22.12.2000) US

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU,
AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU,
CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH,
GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC,
LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW,
MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG,
SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VN,
YU, ZA, ZM, ZW.

(84) Designated States (*regional*): ARIPO patent (GH, GM,
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),
Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR,
GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent
(BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR,
NE, SN, TD, TG).

Published:

— *without international search report and to be republished
upon receipt of that report*

*For two-letter codes and other abbreviations, refer to the "Guid-
ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.*

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(54) Title: **HETEROCYCLINDAZOLE AND AZAINDAZOLE COMPOUNDS AS 5-HYDROXYTRYPTAMINE-6 LIGANDS**

(57) Abstract: The present invention provides a compound of formula I and the use thereof in the therapeutic treatment of disorders related to or affected by the 5-HT₆ receptor.

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HETEROCYCLYLINDAZOLE AND -AZAINDAZOLE COMPOUNDS AS**5-HYDROXYTRYPTAMINE-6 LIGANDS**

5

This invention relates to heterocyclylindazole and -azaindazole compounds useful as 5-hydroxytryptamine-6 ligands, to processes for preparing them, to pharmaceutical compositions containing them and to methods of treatment using them.

10

BACKGROUND OF THE INVENTION

15

A number of central nervous system disorders such as anxiety, depression, motor disorders, etc., are believed to involve a disturbance of the neurotransmitter 5-hydroxytryptamine (5-HT) or serotonin. Serotonin is localized in the central and peripheral nervous systems and is known to affect many types of conditions including psychiatric disorders, motor activity, feeding behavior, sexual activity, and neuroendocrine regulation among others. The effects of serotonin are regulated by the various 5-HT receptor subtypes. Known 5-HT receptors include 5-HT₁, 5-HT₂, 5-HT₃, 5-HT₄, 5-HT₅, 5-HT₆ and 5-HT₇ subtypes.

25

The recently identified human 5-hydroxytryptamine-6 (5-HT₆) receptor subtype has been cloned, and the extensive

distribution of its mRNA has been reported. Highest levels of 5-HT₆ receptor mRNA have been observed in the olfactory tubercle, the striatum, nucleus accumbens, dentate gyrus and CA1, CA2 and CA3 regions of the hippocampus. Northern blots
5 have revealed that 5-HT₆ receptor mRNA appears to be exclusively present in the brain, with little evidence for its presence in peripheral tissues.

The high affinity of a number of antipsychotic agents for the 5-HT₆ receptor, in addition to its mRNA localization
10 in striatum, olfactory tubercle and nucleus accumbens suggests that some of the clinical actions of these compounds may be mediated through this receptor. Compounds which interact with, stimulate or inhibit the 5-HT₆ receptor are commonly referred to as 5-HT₆ ligands. These 5-HT₆
15 receptor ligands are believed to be of potential use in the treatment of a variety of central nervous system disorders such as anxiety, depression, epilepsy, obsessive-compulsive disorders, migraine, cognitive disorders, sleep disorders, feeding disorders, panic attacks, disorders relating to
20 withdrawal from drug abuse, schizophrenia, or the like or in the treatment of certain gastrointestinal disorders such as irritable bowel syndrome.

Therefore, it is an object of this invention to provide compounds which are useful as therapeutic agents in the
25 treatment of a variety of central nervous system disorders related to or affected by the 5-HT₆ receptor.

It is another object of this invention to provide therapeutic methods and pharmaceutical compositions useful for the treatment of central nervous system disorders
30 related to or affected by the 5-HT₆ receptor.

It is a feature of this invention that the compounds provided may also be used to further study and elucidate the 5-HT₆ receptor.

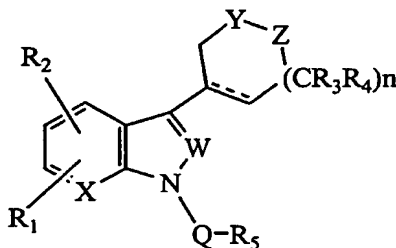
These and other objects and features of the invention will become more apparent by the detailed description set forth hereinbelow.

SUMMARY OF THE INVENTION

10

The present invention provides a compound of formula I

wherein



(I)

Q is SO₂, CO, CONR₂₄, CSNR₂₅ or CH₂;

15

W is N or CR₆;

X is N or CR₇;

Y is NR₈ or CR₉R₁₀;

n is 0 or an integer of 1 or 2;

20

Z is NR₁₁ or CR₁₂R₁₃ with the proviso that when n is 1, Q is SO₂, CO or CH₂, and W is CR₆ then Z must be CR₁₂R₁₃ and with the further provisos that when Y is NR₈ then Z must be CR₁₂R₁₃ and at least one of Y and Z must be NR₈ or NR₁₁;

25

R₁, R₂ and R₇ are each independently H, halogen, CN, OCO₂R₁₄, CO₂R₁₅, CONR₂₉R₃₀, CNR₁₆NR₁₇R₁₈, SO_mR₁₉, NR₂₀R₂₁, OR₂₂, COR₂₃ or a C₁-C₆alkyl, C₂-C₆alkenyl, C₂-

C₆alkynyl, C₃-C₆cycloalkyl, cycloheteroalkyl, aryl or heteroaryl group each optionally substituted; R₃, R₄, R₉, R₁₀, R₁₂ and R₁₃ are each independently H or an optionally substituted C₁-C₆alkyl group;

5 R₅ is an optionally substituted C₁-C₆alkyl, aryl or heteroaryl group;

m is 0 or an integer of 1 or 2;

R₆ is H, halogen, or an optionally substituted C₁-C₆alkyl, C₁-C₆alkoxy, aryl or heteroaryl group;

10 R₈ and R₁₁ are each independently H, CNR₂₆NR₂₇R₂₈ or a C₁-C₆alkyl, C₃-C₆cycloalkyl, cycloheteroalkyl, aryl or heteroaryl group each optionally substituted;

R₁₄, R₁₅, R₂₂ and R₂₃ are each independently H or an optionally substituted C₁-C₆alkyl, C₂-C₆alkenyl, C₂-C₆alkynyl, C₃-C₆cycloalkyl, cycloheteroalkyl, aryl or heteroaryl group;

15 R₁₆, R₁₇, R₁₈, R₂₀, R₂₁, R₂₆, R₂₇, R₂₈, R₂₉ and R₃₀ are each independently H or C₁-C₄alkyl;

R₁₉ is an optionally substituted C₁-C₆alkyl, aryl or heteroaryl group;

20 R₂₄ and R₂₅ are each independently H or an optionally substituted C₁-C₆alkyl, aryl or heteroaryl group; and

---- represents a single bond or a double bond; or

25 the stereoisomers thereof or the pharmaceutically acceptable salts thereof.

The present invention further provides methods and compositions useful for the treatment of central nervous system disorders affected by or related to the 5-HT₆ receptor.

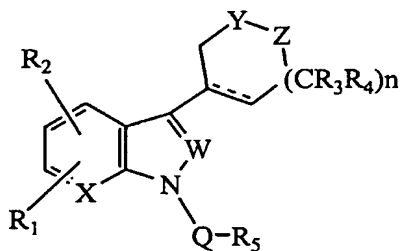
30

DETAILED DESCRIPTION OF THE INVENTION

The 5-hydroxytryptamine-6 (5-HT₆) receptor is one of the most recent receptors to be identified by molecular cloning. Its ability to bind a wide range of therapeutic compounds used in psychiatry, coupled with its intriguing
5 distribution in the brain has stimulated significant interest in new compounds which are capable of interacting with or affecting said receptor. At present, there are no known fully selective agonists. Significant efforts are being made to understand the possible role of the 5-HT₆
10 receptor in psychiatry, cognitive dysfunction, motor function and control, memory, mood and the like. To that end, compounds which demonstrate a binding affinity for the 5-HT₆ receptor are earnestly sought both as an aid in the study of the 5-HT₆ receptor and as potential therapeutic
15 agents in the treatment of central nervous system disorders.

Surprisingly, it has now been found that heterocyclylindazole or -azaindazole compounds of formula I demonstrate affinity for the 5-HT₆ receptor along with significant receptor sub-type selectivity. Advantageously,
20 said formula I compounds are effective therapeutic agents for the treatment of central nervous system (CNS) disorders associated with or affected by the 5-HT₆ receptor. Accordingly, the present invention provides heterocyclylindazole or -azaindazole compounds of formula I

25



(I)

wherein

Q is SO₂, CO, CONR₂₄, CSNR₂₅ or CH₂;

W is N or CR₆;

5 X is N or CR₇;

Y is NR₈ or CR₉R₁₀;

n is 0 or an integer of 1 or 2;

10 Z is NR₁₁ or CR₁₂R₁₃ with the proviso that when n is 1, Q is SO₂, CO or CH₂, and W is CR₆ then Z must be CR₁₂R₁₃ and with the further provisos that when Y is NR₈ then Z must be CR₁₂R₁₃ and at least one of Y and Z must be NR₈ or NR₁₁;

15 R₁, R₂ and R₇ are each independently H, halogen, CN, OCO₂R₁₄, CO₂R₁₅, CONR₂₉R₃₀, CNR₁₆NR₁₇R₁₈, SO_mR₁₉, NR₂₀R₂₁, OR₂₂, COR₂₃ or a C₁-C₆alkyl, C₂-C₆alkenyl, C₂-C₆alkynyl, C₃-C₆cycloalkyl, cycloheteroalkyl, aryl or heteroaryl group each optionally substituted;

R₃, R₄, R₉, R₁₀, R₁₂ and R₁₃ are each independently H or an optionally substituted C₁-C₆alkyl group;

20 R₅ is an optionally substituted C₁-C₆alkyl, aryl or heteroaryl group;

m is 0 or an integer of 1 or 2;

R₆ is H, halogen, or an optionally substituted C₁-C₆alkyl, C₁-C₆alkoxy, aryl or heteroaryl group;

25 R₈ and R₁₁ are each independently H, CNR₂₆NR₂₇R₂₈ or a C₁-C₆alkyl, C₃-C₆cycloalkyl, cycloheteroalkyl, aryl or heteroaryl group each optionally substituted;

R_{14} , R_{15} , R_{22} and R_{23} are each independently H or an optionally substituted C_1 - C_6 alkyl, C_2 - C_6 alkenyl, C_2 - C_6 alkynyl, C_3 - C_6 cycloalkyl, cycloheteroalkyl, aryl or heteroaryl group;

5 R_{16} , R_{17} , R_{18} , R_{20} , R_{21} , R_{26} , R_{27} , R_{28} , R_{29} and R_{30} are each independently H or C_1 - C_4 alkyl;

R_{19} is an optionally substituted C_1 - C_6 alkyl, aryl or heteroaryl group;

10 R_{24} and R_{25} are each independently H or an optionally substituted C_1 - C_6 alkyl, aryl or heteroaryl group; and

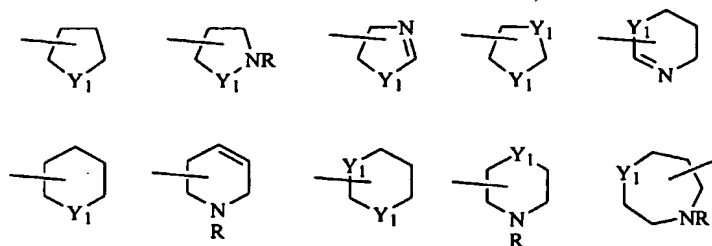
---- represents a single bond or a double bond; or the stereoisomers thereof or the pharmaceutically acceptable salts thereof.

15

As used in the specification and claims, the term halogen designates Br, Cl, I or F; the term aryl designates phenyl or naphthyl; and the term cycloheteroalkyl designates a 5- to 7-membered monocyclic ring system containing 1 or 2 heteroatoms, which may be the same or different, selected from nitrogen, oxygen and sulfur and optionally containing one double bond. Exemplary of the cycloheteroalkyl ring systems included in the term as designated herein are the following rings wherein Y_1 is NR, O or S and R is H or an optional substituent as described hereinbelow.

20

25



For example the term cycloheteroalkyl includes radicals derived from rings such as piperidine, morpholine, piperazine and pyrrolidine.

5 Similarly, as used in the specification and claims, the term heteroaryl designates a 5- to 12-membered mono-, bi- or tri-cyclic aromatic ring system containing 1 to 3 heteroatoms, which may be the same or different, selected from N, O or S. Such heteroaryl ring systems include
10 pyrrolyl, azolyl, oxazolyl, thiazolyl, imidazolyl, furyl, thienyl, quinolinyl, isoquinolinyl, indolinyl, benzothienyl, benzofuranyl, benzisoxazolyl, imidazo[1,2-a]pyridinyl, imidazo[2,1-b]thiazolyl benzo[d]imidazo[2,1-b]thiazolyl and the like. The term haloalkyl designates a C_nH_{2n+1} group
15 having from one to $2n+1$ halogen atoms which may be the same or different; and the term haloalkoxy designates an OC_nH_{2n+1} group having from one to $2n+1$ halogen atoms which may be the same or different.

20 In the specification and claims, when the terms C_1 - C_6 alkyl, C_2 - C_6 alkenyl, C_2 - C_6 alkynyl, C_3 - C_7 cycloalkyl, cycloheteroalkyl, C_1 - C_6 alkanoyl, aryl or heteroaryl are designated as being optionally substituted, the substituent groups which are optionally present may be one or more of
25 those customarily employed in the development of pharmaceutical compounds or the modification of such compounds to influence their structure/activity, persistence, absorption, stability or other beneficial property. Specific examples of such substituents include
30 halogen atoms, nitro, cyano, thiocyanato, cyanato, hydroxyl, alkyl, haloalkyl, alkoxy, haloalkoxy, amino, alkylamino,

dialkylamino, formyl, alkoxycarbonyl, carboxyl, alkanoyl, alkylthio, alkylsophinyl, alkylsulphonyl, carbamoyl, alkylamido, phenyl, phenoxy, benzyl, benzyloxy, cycloheteroalkyl, heteroaryl or cycloalkyl groups, preferably halogen atoms or lower alkyl groups. Typically, up to 3 substituents may be present. When any of the foregoing substituents represents or contains an alkyl substituent group, this may be linear or branched and may contain up to 12, preferably up to 6, more preferably up to 4 carbon atoms such as methyl, ethyl, propyl, isopropyl, and n- and t-butyl.

Pharmaceutically acceptable salts may be any acid addition salt formed by a compound of formula I and a pharmaceutically acceptable acid such as phosphoric, sulfuric, hydrochloric, hydrobromic, citric, maleic, mandelic, malonic, succinic, fumaric, acetic, lactic, nitric, sulfonic, p-toluene sulfonic, methane sulfonic acid or the like.

Compounds of the invention include esters, carbamates or other conventional prodrug forms, which in general, are functional derivatives of the compounds of the invention and which are readily converted to the inventive active moiety *in vivo*. Correspondingly, the method of the invention embraces the treatment of the various conditions described hereinabove with a compound of formula I or with a compound which is not specifically disclosed but which, upon administration, converts to a compound of formula I *in vivo*. Also included are metabolites of the compounds of the present invention defined as active species produced upon introduction of these compounds into a biological system.

Compounds of the invention may exist as one or more stereoisomers. The various stereoisomers include enantiomers, diastereomers, atropisomers and geometric isomers. One skilled in the art will appreciate that one stereoisomer may be more active or may exhibit beneficial effects when enriched relative to the other stereoisomer(s) or when separated from the other stereoisomer(s). Additionally, the skilled artisan knows how to separate, enrich or selectively prepare said stereoisomers. Accordingly, the present invention comprises compounds of Formula I, the stereoisomers thereof and the pharmaceutically acceptable salts thereof. The compounds of the invention may be present as a mixture of stereoisomers, individual stereoisomers, or as an optically active form.

15

Examples of R_1 and R_2 are independently hydrogen, halogen (such as fluorine, chlorine) C_1 - C_6 alkyl, C_1 - C_6 alkoxy (eg methoxy), hydroxy, and cyano; for example where substitution is in the 5- and/or 6- position.

20

Examples of n are 0, 1 or 2. Examples of R_3 and R_4 when present are independently hydrogen and (C_1-C_6) alkyl.

Examples of Y are NR_8 and CR_9R_{10} where R_8 , R_9 and R_{10} are each selected from hydrogen, C_1 - C_6 alkyl and C_1 - C_6 alkyl substituted by for example aryl; e.g., Y may be $-CH_2-$, $-NH-$, $-NMe-$, $-N(Bz)-$ and $-N(CH_2CH_2phenyl)-$.

25

Examples of Z are NR_{11} and $\text{CR}_{12}\text{R}_{13}$ where R_{11} , R_{12} and R_{13} are each selected from hydrogen, $\text{C}_1\text{-C}_6$ alkyl and $\text{C}_1\text{-C}_6$ alkyl substituted by for example aryl; e.g., Y may be $-\text{CH}_2-$, $-\text{NH}-$, $-\text{NMe}-$, $-\text{N}(\text{Bz})-$ and $-\text{N}(\text{CH}_2\text{CH}_2\text{phenyl})-$.

5

Q may be for example SO_2 , C=O or CH_2 .

Examples of R_5 are aryl e.g., phenyl or naphthyl, or heteroaryl e.g., thienyl (such as thien-2-yl), thiazolyl (e.g., thiazol-2-yl), benzothienyl (such as benzo[b]thien-2 or 4-yl); quinolyl (such as quinolin-8-yl); imidazo[1,2-a]pyridinyl, imidazo[2,1-b]thiazolyl and benzo[d]imidazo[2,1-b]thiazolyl; said aryl and heteroaryl groups being unsubstituted or optionally substituted by one or more (e.g., 1 to 3) substituents the same or different as described herein. Such substituents include nitro, cyano, thiocyanato, cyanato, hydroxyl, alkyl of 1-6 carbon atoms, halo($\text{C}_1\text{-C}_6$)alkyl, ($\text{C}_1\text{-C}_6$)alkoxy, halo($\text{C}_1\text{-C}_6$)alkoxy, amino, ($\text{C}_1\text{-C}_6$)alkylamino, di-($\text{C}_1\text{-C}_6$ alkyl)amino, formyl, ($\text{C}_1\text{-C}_6$)alkoxy)carbonyl, carboxyl, ($\text{C}_1\text{-C}_6$)alkanoyl, ($\text{C}_1\text{-C}_6$)alkylthio, ($\text{C}_1\text{-C}_6$)alkylsulphinyl, ($\text{C}_1\text{-C}_6$)alkyl-sulphonyl, carbamoyl, ($\text{C}_1\text{-C}_6$)alkylamido, phenyl, phenoxy, benzyl, benzyloxy, heteroaryl and cycloheteroalkyl or ($\text{C}_3\text{-C}_8$)cycloalkyl groups. Such optionally substituted groups for R_8 are also examples of aryl or heteroaryl for each of R_1 , R_2 , R_6 , R_7 , R_8 , R_{11} , R_{14} , R_{15} , R_{19} , R_{22} , R_{23} , R_{24} and R_{25} .

30

Examples of W are CR_6 wherein R_6 is for example hydrogen or ($\text{C}_1\text{-C}_6$)alkyl or W is N.

Examples of X are CR₇ wherein R₇ is for example hydrogen or (C₁-C₆)alkyl or X is N.

When X is N, W may be for example CR₇. When X is CR₇,
5 W may be for example N or CR₆.

Preferred compounds of the invention are those compounds of formula I wherein n is 1 and Y is NR₈. Also preferred are those compounds of formula I wherein n is 0.
10 Further preferred compounds of the invention are those compounds of formula I wherein Q is SO₂ or CO and R₅ is an optionally substituted aryl or heteroaryl group. Another group of preferred compounds is those compounds of formula I wherein ---- represents a single bond.

15 More preferred compounds of the invention are those compounds of formula I wherein n is 0; Q is SO₂; X is CR₇; and Z is NR₁₁. Another group of more preferred inventive compounds are those formula I compounds wherein n is 1; Q is
20 SO₂; Y is NR₈; X is CR₇; and R₅ is an optionally substituted aryl group. Further more preferred compounds of the invention are those compounds of formula I wherein n is 0; Q is SO₂; W is CR₆; X is CR₇; Z is NR₁₁; R₅ is an optionally substituted aryl group; and ---- represents a single bond.

25 Among the preferred compounds of the invention are:

- 1-(phenylsulfonyl)-3-(piperidin-4-yl)-1H-indazole;
- 1-(4-nitrophenyl)-3-(piperidin-4-yl)-1H-indazole;
- 1-(4-fluorophenyl)-3-(piperidin-4-yl)-1H-indazole;
- 30 1-(3,4-dimethoxyphenyl)-3-(piperidin-4-yl)-1H-indazole;

- 1- (4-fluorophenylsulfonyl) -3- (1-methyl-pyrrolidin-3-yl) -1H-indole;
- 1- (4-chlorophenylsulfonyl) -3- (1-methylpyrrolidin-3-yl) -1H-indole;
- 5 1- (naphth-2-ylsulfonyl) -3- (1-methylpyrrolidin-3-yl) -1H-indole;
- 1- (4-aminophenylsulfonyl) -3- (1-methylpyrrolidin-3-yl) -1H-indole;
- 1- (3,4-dimethoxyphenylsulfonyl) -3- (1-methylpyrrolidin-3-yl) -1H-indole;
- 10 1- (3,4-dichlorophenylsulfonyl) -3- (1-methylpyrrolidin-3-yl) -1H-indole;
- 1- [(4,5-dichlorothien-2-yl)sulfonyl] -3- (1-methyl-pyrrolidin-3-yl) -1H-indole;
- 15 1- (2-bromophenylsulfonyl) -3- (1-methylpyrrolidin-3-yl) -1H-indole;
- 1- (4-iodophenylsulfonyl) -3- (1-methylpyrrolidin-3-yl) -1H-indole;
- 1- (2-iodophenylsulfonyl) -3- (1-methylpyrrolidin-3-yl) -1H-indole;
- 20 1- (4-aminophenylsulfonyl) -3- (1-benzylpyrrolidin-3-yl) -1H-indole;
- 3- (1-benzylpyrrolidin-3-yl) -1- (4-methylphenylsulfonyl) -1H-indole;
- 25 3- (1-benzylpyrrolidin-3-yl) -1- (3,4-dichlorophenyl-sulfonyl) -1H-indole;
- 3- (1-benzylpyrrolidin-3-yl) -1- (2-bromophenylsulfonyl) -1H-indole;
- 5- [3- (1-benzylpyrrolidin-3-yl) -indole-1-sulfonyl] -4-methylthiazol-2-ylamine;
- 30

- 3-(1-benzylpyrrolidin-3-yl)-1-[(5-bromothien-2-yl)sulfonyl]-1H-indole;
- 1-phenylsulfonyl-3-(1-methylpyrrolidin-3-yl)-1H-pyrrolo[2,3-b]pyridine;
- 5 1-phenylsulfonyl-3-(1-methylpyrrolidin-3-yl)-1H-indazole;
- 1-phenylsulfonyl-3-(1-methyl-2,5-dihydro-1H-pyrrol-3-yl)-1H-pyrrolo[2,3-b]pyridine;
- 1-phenylsulfonyl-3-(1-methyl-2,5-dihydro-1H-pyrrol-3-yl)-1H-indole;
- 10 1-phenylsulfonyl-3-(1-methylpiperidin-4-yl)-1H-indazole;
- 1-phenylsulfonyl-3-(1-methyl-1,2,3,6-tetrahydropyridin-4-yl)-1H-indazole;
- 1-phenylsulfonyl-3-(1-methylazepan-4-yl)-1H-pyrrolo[2,3-b]pyridine;
- 15 1-phenylsulfonyl-3-(1-methylazepan-4-yl)-1H-indole;
- 1-phenylsulfonyl-5-fluoro-3-(1-methylazepan-4-yl)-1H-indole;
- 1-phenylsulfonyl-3-(1-methyl-2,3,6,7-tetrahydro-1H-azepin-4-yl)-1H-indole;
- 1-phenylsulfonyl-3-(1-methyl-2,5,6,7-tetrahydro-1H-azepin-4-yl)-1H-indole;
- 20 1-phenylsulfonyl-3-(1-methyl-2,3,6,7-tetrahydro-1H-azepin-4-yl)-1H-pyrrolo[2,3-b]pyridine;
- 1-phenylsulfonyl-5-fluoro-3-(1-methyl-2,3,6,7-tetrahydro-1H-azepin-4-yl)-1H-indole;
- 25 1-phenylsulfonyl-5-fluoro-3-(1-methyl-2,5,6,7-tetrahydro-1H-azepin-4-yl)-1H-indole;
- 1-(benzo[b]thioen-4-ylsulfonyl)-3-(1-methylpyrrolidin-3-yl)-1H-pyrrolo[2,3-b]pyridine;
- 1-(3-fluorophenylsulfonyl)-3-(1-methylpyrrolidin-3-yl)-1H-indazole;
- 30

- 1- (2,5-dichlorophenylsulfonyl) -3- (2,5-dihydro-1H-pyrrol-3-yl) -1H-pyrrolo[2,3-b]pyridine;
- 8- [3- (1-methyl-2,5-dihydro-1H-pyrrol-3-yl) indole-1-sulfonyl] -quinoline;
- 5 1-phenylsulfonyl-5-chloro-3- (1-methylpiperidin-4-yl) -1H-indazole;
- 5-methoxy-3- (1-methyl-1,2,3,6-tetrahydropyridin-4-yl) -1- (naphth-1-yl-sulfonyl) -1H-indazole;
- 3- (1-methylazepan-4-yl) -1- (naphth-1-yl-sulfonyl) -1H-pyrrolo[2,3-b]pyridine;
- 10 3- (1-methylazepan-4-yl) -1- (naphth-1-yl-sulfonyl) -1H-indole;
- 1- (benzo[b]thien-4-ylsulfonyl) -5-fluoro-3- (1-methylazepan-4-yl) -1H-indole;
- 8- [3- (1-methyl-2,3,6,7-tetrahydro-1H-azepin-4-yl) -indole-1-sulfonyl] -quinoline;
- 15 3- (1-methyl-2,5,6,7-tetrahydro-1H-azepin-4-yl) -1- (naphth-1-ylsulfonyl) -1H-indole;
- 8- [3- (1-methyl-2,3,6,7-tetrahydro-1H-azepin-4-yl) -pyrrolo[2,3-b]pyridine-1-sulfonyl] -quinoline;
- 20 8- [5-fluoro-3- (1-methyl-2,3,6,7-tetrahydro-1H-azepin-4-yl) -indole-1-sulfonyl] -quinoline;
- 5-fluoro-3- (1-methyl-2,5,6,7-tetrahydro-1H-azepin-4-yl) -1- (naphth-1-ylsulfonyl) -1H-indole;
- 1- (benzo[b]thien-4-ylsulfonyl) -3- (1-benzyl-pyrrolidin-3-yl) -1H-pyrrolo[2,3-b]pyridine;
- 25 1- (3-fluoro-phenylsulfonyl) -3- (1-phenethyl-pyrrolidin-3-yl) -1H-indazole;
- 1- (2,5-dichlorophenylsulfonyl) -3- (1-ethyl-2,5-dihydro-1H-pyrrol-3-yl) -1H-pyrrolo[2,3-b]pyridine;
- 30 3- (1-methyl-2,5-dihydro-1H-pyrrol-3-yl) -1- (naphth-2-ylsulfonyl) -1H-indole;

- 5-chloro-1-(3-fluorophenylsulfonyl)-3-piperidin-4-yl-1H-indazole;
- 5-methoxy-1-(naphth-1-ylsulfonyl)-3-(1,2,2-trimethyl-1,2,3,6-tetrahydro-pyridin-4-yl)-1H-indazole;
- 5 1-(naphth-1-ylsulfonyl)-3-(1-phenethyl-azepan-4-yl)-1H-pyrrolo[2,3-b]pyridine;
- 3-azepan-4-yl-1-(naphth-1-ylsulfonyl)-1H-indole;
- 3-azepan-4-yl-1-(3-chloro-5-methyl-benzo[b]thien-2-ylsulfonyl)-5-fluoro-1H-indole;
- 10 8-[3-(1-phenethyl-2,3,6,7-tetrahydro-1H-azepin-4-yl)-indole-1-sulfonyl]-quinoline;
- 3-[1-(3,3-dimethylbutyl)-2,5,6,7-tetrahydro-1H-azepin-4-yl]-1-(naphth-2-ylsulfonyl)-1H-indole;
- 1-(2,3-dichlorophenylsulfonyl)-3-(1-methyl-2,3,6,7-tetrahydro-1H-azepin-4-yl)-1H-pyrrolo[2,3-b]pyridine;
- 15 1-[(3-chloro-5-methoxyphenylsulfonyl)]-3-(2,2-dimethyl-2,3,6,7-tetrahydro-1H-azepin-4-yl)-5-fluoro-1H-indole;
- 3-azepan-4-yl-5-fluoro-1-(naphth-2-ylsulfonyl)-1H-indole;
- 1-benzenesulfonyl-3-piperidin-3-yl-1H-indole;
- 20 1-(4-isopropyl-benzenesulfonyl)-3-piperidin-3-yl-1H-indole;
- 1-(5-chloro-thiophene-2-sulfonyl)-3-piperidin-3-yl-1H-indole;
- 1-(3-chloro-benzenesulfonyl)-3-piperidin-3-yl-1H-indole;
- 1-(3,4-difluoro-benzenesulfonyl)-3-piperidin-3-yl-1H-indole;
- 25 1-(4-trifluoromethoxy-benzenesulfonyl)-3-piperidin-3-yl-1H-indole;
- 1-(4-methoxy-benzenesulfonyl)-3-piperidin-3-yl-1H-indole;
- 1-(4-trifluoromethyl-benzenesulfonyl)-3-piperidin-3-yl-1H-indole;
- 30 1-(3-chloro-4-methyl-benzenesulfonyl)-3-piperidin-3-yl-1H-indole;

- 1- (2-chloro-4-trifluoromethyl-benzenesulfonyl) -3-piperidin-3-yl-1H-indole;
- 1- (2-naphthylenesulfonyl) -3-piperidin-3-yl-1H-indole;
- 1- (5-chloro-3-methyl-benzo[b]thiophene-2-sulfonyl) -3-
- 5 piperidin-3-yl-1H-indole;
- 1- (2,6-dichloro-imidazo[2,1-b]thiazole-5-sulfonyl) -3-piperidin-3-yl-1H-indole;
- 2-chloro-3- (3-piperidin-3-yl-indole-1-sulfonyl) -imidazo[1,2-a]pyridine;
- 10 2-chloro-3- (3-piperidin-3-yl-indole-1-sulfonyl) -benzo[d]imidazo[2,1-b]thiazole;
- 1- (4-isopropyl-benzenesulfonyl) -3-piperidin-3-yl-1H-pyrrolo[2,3-b]pyridine;
- 1- (5-chloro-thiophene-2-sulfonyl) -3-piperidin-3-yl-1H-pyrrolo[2,3-b]pyridine;
- 15 1- (3-chloro-benzenesulfonyl) -3-piperidin-3-yl-1H-pyrrolo[2,3-b]pyridine;
- 1- (3,4-difluoro -benzenesulfonyl) -3-piperidin-3-yl-1H-pyrrolo[2,3-b]pyridine;
- 20 1- (4-trifluoromethoxy-benzenesulfonyl) -3-piperidin-3-yl-1H-pyrrolo[2,3-b]pyridine;
- 1- (3-chloro-4-methyl-benzenesulfonyl) -3-piperidin-3-yl-1H-pyrrolo[2,3-b]pyridine;
- 1- (2-chloro-4-trifluoromethyl-benzenesulfonyl) -3-piperidin-3-yl-1H-pyrrolo[2,3-b]pyridine;
- 25 1- (2-naphthylenesulfonyl) -3- piperidin-3-yl-1H-pyrrolo[2,3-b]pyridine;
- 1- (5-chloro-3-methyl-benzo[b]thiophene-2-sulfonyl) -3-piperidin-3-yl-1H-pyrrolo[2,3-b]pyridine;
- 30 2-chloro-3- (3-piperidin-3-yl-pyrrolo[2,3-b]pyridine-1-sulfonyl) -imidazo[1,2-a]pyridine;

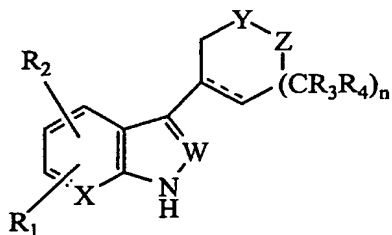
2-chloro-3-(3-piperidin-3-yl-pyrrolo[2,3-b]pyridine-1-sulfonyl)-benzo[d]imidazo[2,1-b]thiazole;
or the pharmaceutically acceptable salts thereof.

5

This invention also provides processes for preparing compounds of formula (I) which processes comprise one of the following:

10

a) reacting a compound of formula



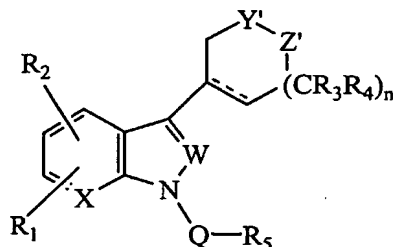
wherein W, X, Y, Z, R₁, R₂, R₃ and R₄ are as defined herein, with an appropriate sulphonylating, acylating, carbamoylating, thiocarbamoylating or alkylating agent containing the group:



where R₅ is as defined above and Q is SO₂, CO, CONR₂₄, CSNR₂₅ or CH₂; said reactants protected on reactive sites and/or on reactive substituent groups as required, and removing any protecting groups to give a corresponding compound of formula (I);

or

25 b) removing a protecting group from a compound of formula



wherein Q, W, X, R₁, R₂, R₃, R₄ and R₅ are as defined herein
 and one of Y' and Z' is N-G where G is a protecting group
 5 and the other is CR₉R₁₀ or CR₁₂R₁₃ as appropriate to give a
 compound of formula (I) wherein Y or Z is NH;

or

c) alkylating a compound of formula (I) as defined in
 10 above wherein R₈ or R₁₁ is hydrogen with an alkylating agent
 of formula R₈-L or R₁₁-L wherein L is a leaving group, such
 as halogen, and R₈ and R₁₁ are each as defined in herein
 excepting hydrogen, to give a corresponding compound of
 formula (I);

15

or

d) converting a compound of formula (I) having a
 reactive substituent group to a different compound of
 formula I;

20

or

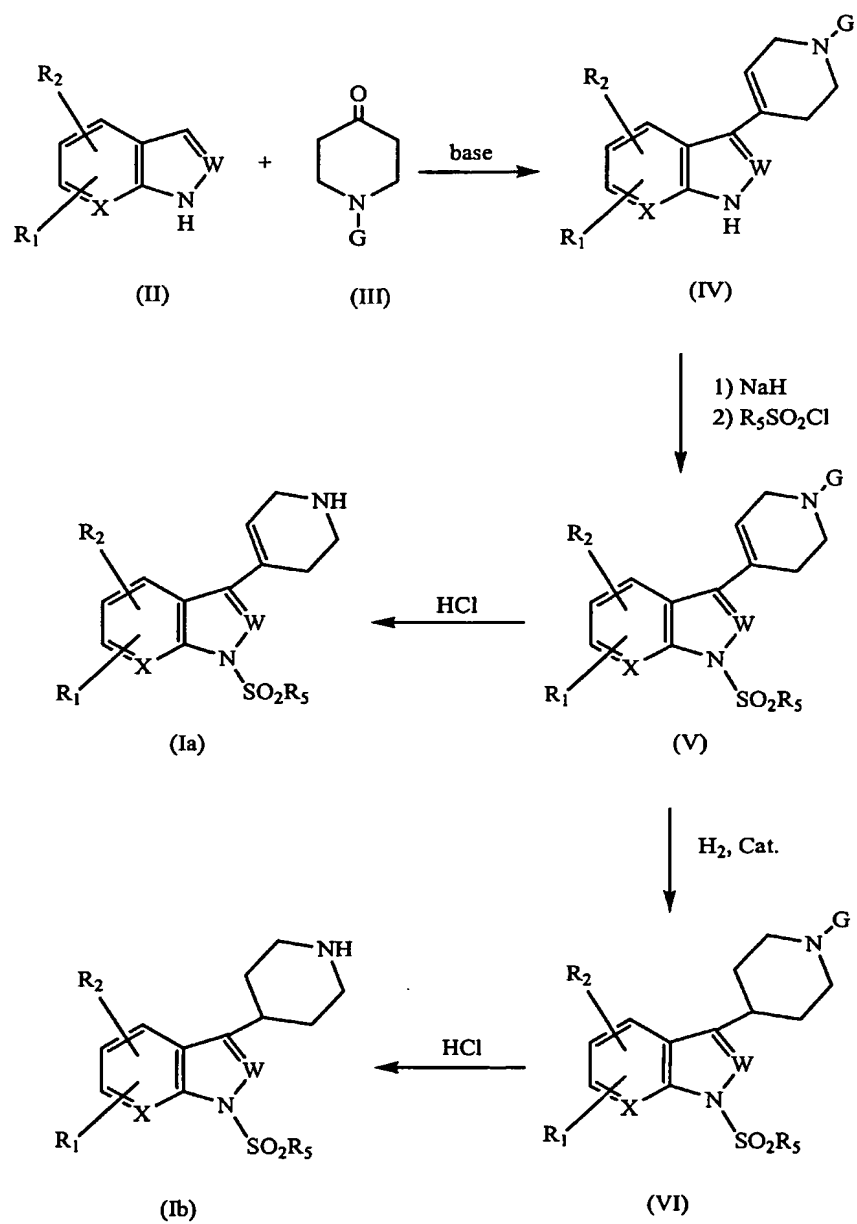
e) converting a basic compound of formula (I) to an acid
 addition salt or vice versa.

or

25 f) isolating an isomer of a compound of formula (I) from a
 mixture of isomers.

Methods for carrying out the reactions described above are well known to those skilled in the art and/or are illustrated herein. In any of the reactions described herein
5 reactive substituent groups or sites in the molecule may be protected prior to reaction by use of appropriate protecting groups inert to the reaction conditions and removed after the reaction.

10 In detail, compounds of the invention may conveniently be prepared using conventional synthetic methods and, if required, standard separation or isolation techniques. For example, compounds of formula I wherein n is 1; Q is SO₂; Y is CH₂; Z is NH; and ---- represents a double bond (Ia) may
15 be prepared by reacting a compound of formula II with a protected 4- piperidone compound of formula III, such as 1-t-butoxycarbonyl-4-piperidone, in the presence of a base to give the protected tetrahydropyridinyl compound of formula IV; sulfonating said formula IV compound to give the
20 protected 1-sulfonyl derivative of formula V; and deprotecting the formula V compound to give the desired formula Ia product. Alternatively, the formula V compound may be reduced to give the formula VI protected piperidin-4-yl derivative and deprotection of the formula VI compound
25 affords the compound of formula I wherein n is 1; Q is SO₂; Y is CH₂, Z is NH; and ---- represents a single bond (1b). The reaction schemes are shown in flow diagram I wherein G represents a protecting group.

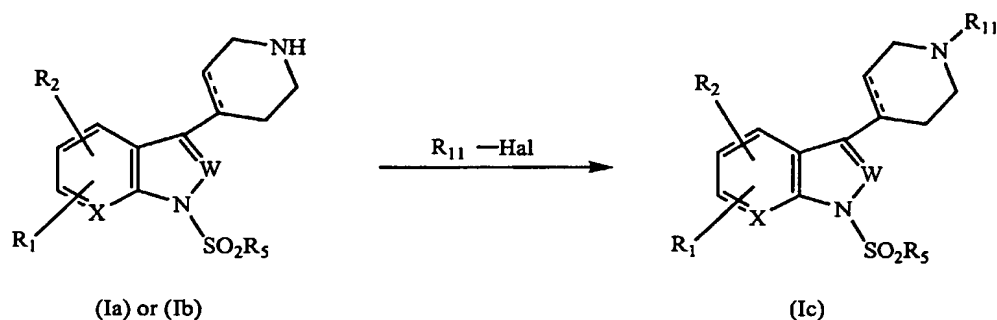
FLOW DIAGRAM I

Commonly used protecting groups include t-butylcarboxylate, benzyl, acetyl, benzyloxycarbonyl, or any conventional group known to protect a basic nitrogen in standard synthetic procedures.

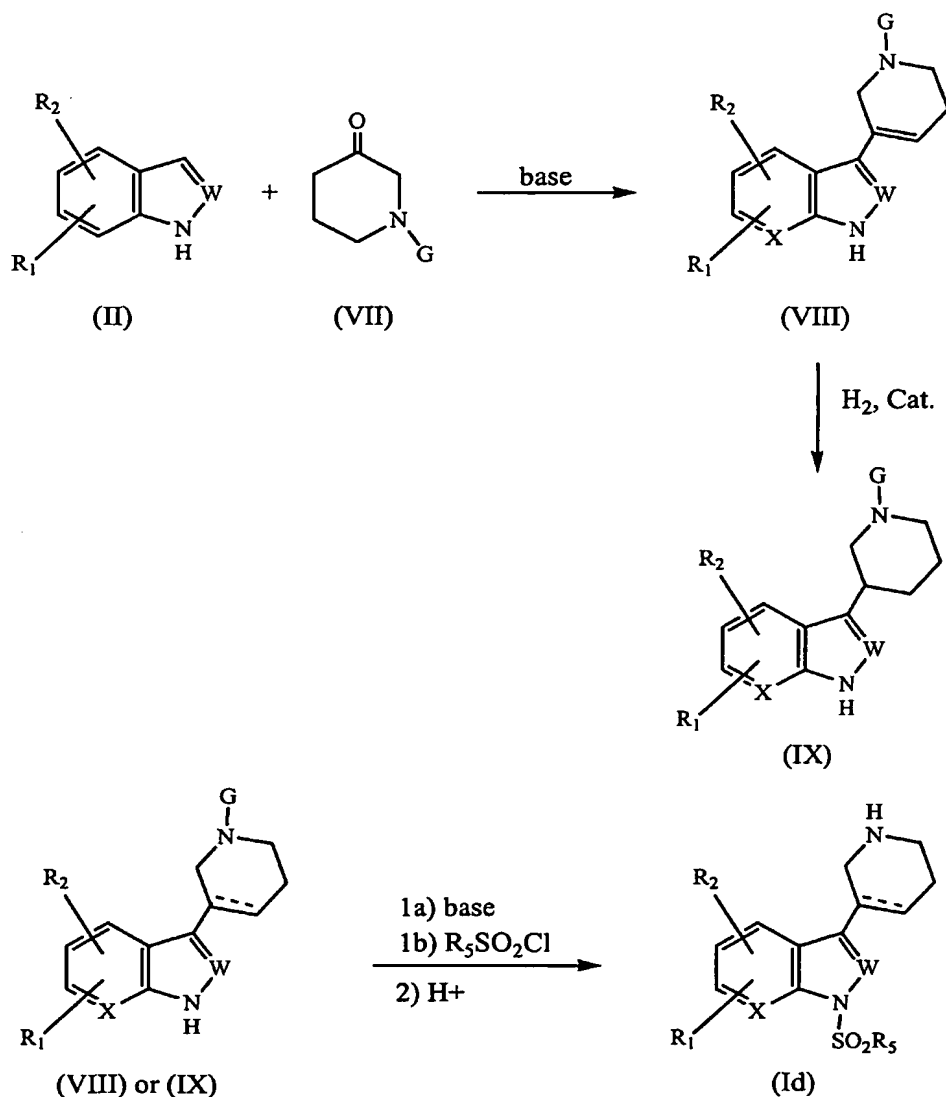
- 5 The corresponding compounds of formula I wherein Z is NR_{11} and R_{11} is other than H may be prepared by alkylating the formula Ia or Ib compound with an alkylating agent $\text{R}_{11}\text{-Hal}$, wherein Hal is Cl, Br or I. The reaction is illustrated in flow diagram II.

10

FLOW DIAGRAM II



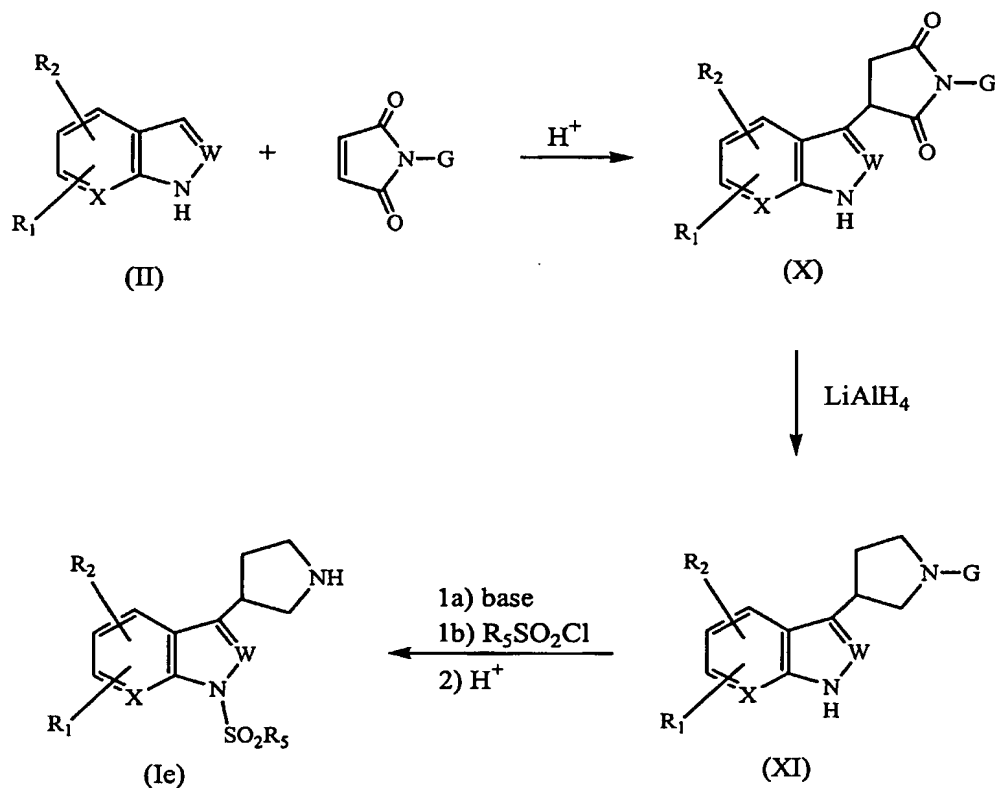
- Similarly, compounds of formula I wherein n is 1; Q is SO_2 ; Y is NH and Z is CH_2 (Id) may be prepared by reacting a
 15 formula II compound with a protected 3-piperidone of formula VII in the presence of a base to give the protected tetrahydropyridinyl compound of formula VIII; reducing said formula VIII compound via catalytic hydrogenation to give the compound of formula IX; sulfonating the formula VIII or
 20 IX compound to give the corresponding protected 1-sulfonyl derivative and deprotecting said derivative to give the desired product of formula Id. The reaction sequence is shown in flow diagram III wherein G represents a protecting group.

FLOW DIAGRAM III

- 5 Compounds of formula I wherein n is 0, Q is SO_2 ; Y is CH_2 ; Z is NH and ---- represents a single bond (Ie) may be prepared by reacting a compound of formula II with a protected maleimide in the presence of an acid to give the compound of formula X; reducing the formula X compound with

LiAlH₄ to give the 3-pyrrolidinyl compound of formula XI and sulfonating and deprotecting as described hereinabove to give the desired product of formula Ie. The reactions are shown in flow diagram IV wherein G represents a protecting group.

FLOW DIAGRAM IV



10

Utilizing the reactions shown in flow diagrams I, II, and III hereinabove and employing the appropriate pyrrolidone or homopiperidone affords compounds of formula I wherein n is 0 or 2 and Q is SO₂. Compounds of formula Id or Ie may be alkylated as shown in flow diagram III to give the corresponding formula I products wherein R₈ or R₁₁ is

15

other than H. Compounds of formula I wherein Q is CO, CONR₂₄ or CH₂ may be prepared by reacting the protected intermediate of formula IV, VIII, IX or XI with the appropriate carbonyl halide, carbamoyl halide or alkyl halide, respectively. These and other literature procedures may be utilized to prepare the formula I compounds of the invention.

Advantageously, the inventive compound of formula I may be utilized in the treatment of central nervous system disorders relating to or affected by the 5-HT₆ receptor such as motor, mood, psychiatric, cognitive, neurodegenerative, or the like disorders. In particular, CNS disorders such as anxiety, depression, schizophrenia, Alzheimer's disease, Parkinson's disease, eating disorders, disorders related to alcohol or drug withdrawal, sexual dysfunction, attention deficit, memory loss or the like. Accordingly, the present invention provides a method for the treatment of a disorder of the central nervous system (CNS) related to or affected by the 5-HT₆ receptor in a patient in need thereof which comprises providing said patient with a therapeutically effective amount of a compound of formula I as described hereinabove. The compounds may be provided via oral or parenteral administration or in any common manner known to be an effective administration of a therapeutic agent to a patient in need thereof.

The therapeutically effective amount provided in the treatment of a specific CNS disorder may vary according to the specific condition(s) being treated, the size, age and response pattern of the patient, the severity of the disorder, the judgment of the attending physician and the like. In general, effective amounts for daily oral administration may be about 0.01 to 1,000 mg/kg, preferably about 0.5 to 500 mg/kg and effective amounts for parenteral administration may be about 0.1 to 100 mg/kg, preferably about 0.5 to 50 mg/kg.

In actual practice, the compounds of the invention are administered in a solid or liquid form, either neat or in combination with one or more conventional pharmaceutical carriers or excipients. Accordingly, the present invention
5 provides a pharmaceutical composition which comprises a pharmaceutically acceptable carrier and an effective amount of a compound of formula I as described hereinabove.

Solid carriers suitable for use in the composition of the invention include one or more substances which may also
10 act as flavoring agents, lubricants, solubilizers, suspending agents, fillers, glidants, compression aides, binders, tablet-disintegrating agents or encapsulating materials. In powders, the carrier may be a finely divided solid which is in admixture with a finely divided compound
15 of formula I. In tablets, the formula I compound may be mixed with a carrier having the necessary compression properties in suitable proportions and compacted in the shape and size desired. Said powders and tablets may contain up to 99% by weight of the formula I compound. Solid
20 carriers suitable for use in the composition of the invention include calcium phosphate, magnesium stearate, talc, sugars, lactose, dextrin, starch, gelatin, cellulose, methyl cellulose, sodium carboxymethyl cellulose, polyvinylpyrrolidone, low melting waxes and ion exchange
25 resins.

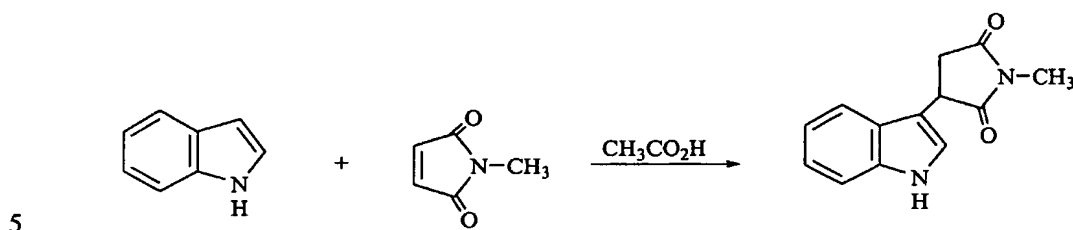
Any pharmaceutically acceptable liquid carrier suitable for preparing solutions, suspensions, emulsions, syrups and elixirs may be employed in the composition of the invention. Compounds of formula I may be dissolved or suspended in a
30 pharmaceutically acceptable liquid carrier such as water, an organic solvent, or a pharmaceutically acceptable oil or fat, or a mixture thereof. Said liquid composition may contain other suitable pharmaceutical additives such as solubilizers, emulsifiers, buffers, preservatives,
35 sweeteners, flavoring agents, suspending agents, thickening

agents, coloring agents, viscosity regulators, stabilizers, osmo-regulators, or the like. Examples of liquid carriers suitable for oral and parenteral administration include water (particularly containing additives as above, e.g.,
5 cellulose derivatives, preferably sodium carboxymethyl cellulose solution), alcohols (including monohydric alcohols and polyhydric alcohols, e.g., glycols) or their derivatives, or oils (e.g., fractionated coconut oil and arachis oil). For parenteral administration the carrier may
10 also be an oily ester such as ethyl oleate or isopropyl myristate.

Compositions of the invention which are sterile solutions or suspensions are suitable for intramuscular, intraperitoneal or subcutaneous injection. Sterile
15 solutions may also be administered intravenously. Inventive compositions suitable for oral administration may be in either liquid or solid composition form.

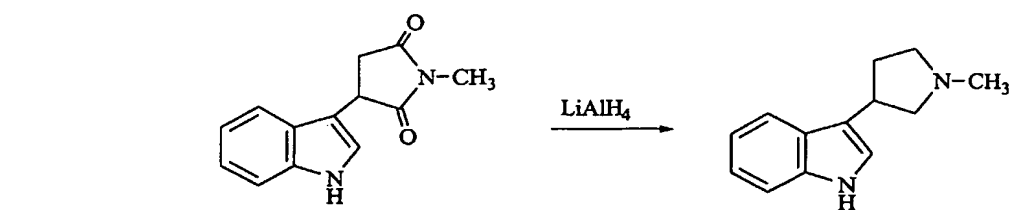
For a more clear understanding, and in order to illustrate the invention more clearly, specific examples
20 thereof are set forth hereinbelow. The following examples are merely illustrative and are not to be understood as limiting the scope and underlying principles of the invention in any way.

Unless otherwise stated, all parts are parts by weight.
25 The terms HPLC and NMR designate high performance liquid chromatography and nuclear magnetic resonance, respectively.

EXAMPLE 1Preparation of 3-(1H-Indol-3-yl)-1-methylpyrrolidine-2,5-dione

A mixture of indole (3.14g) and N-methylmaleimide (6.2g, 3 equiv.) in acetic acid is heated at 105°C for 16 hr, cooled to room temperature, held for 16 hr and filtered. The filtercake is washed with acetic acid and dried to afford the title product, 5.5g, identified by HPLC and mass spectral analyses.

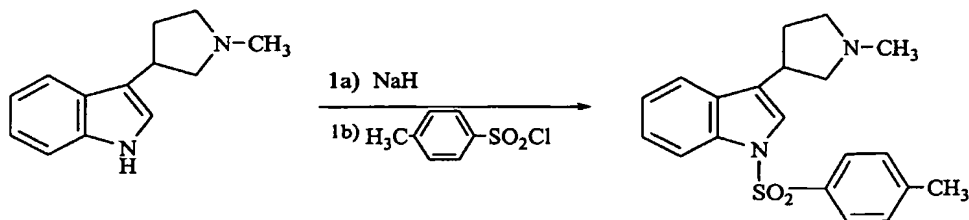
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EXAMPLE 2Preparation of 3-(1-methylpyrrolidin-3-yl)-1H-indole

A solution of 3-(1-H-indol-3-yl)-1-methyl-pyrrolidine-2,5-dione (1.4g) in tetrahydrofuran is treated with LiAlH_4 (12 mL, 1.0M solution, 2 equiv), stirred at 50°C for 8 hr, cooled to room temperature, quenched with water and 15%

aqueous NaOH and filtered. The filtrate is dried over MgSO_4 and concentrated *in vacuo* to afford the title product as an oil, 1.1 g, identified by HPLC and mass spectral analyses.

5

EXAMPLE 3Preparation of 3-(1-methylpyrrolidin-3-yl)-1-[4-(methylphenyl)sulfonyl]-1H-indole

10

A solution of 3-(1-methylpyrrolidin-3-yl)-1H-indole (50.1 mg, 0.25 mmol) in tetrahydrofuran is treated sequentially with NaH (60% dispersion in mineral oil, 0.75 mmol) and 4-methylphenylsulfonyl chloride (47 mg, 0.25 mmol), stirred for 12 hr and concentrated *in vacuo* to give a residue. Purification of the residue by HPLC affords the title product as a solid, characterized by HPLC and mass spectral analyses, $[\text{M}+\text{H}]$ 355.15, LCMS¹ retention time 1.82 min.

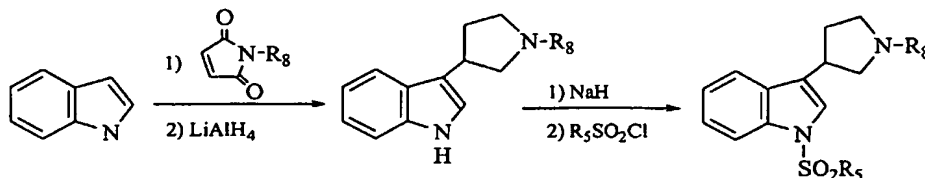
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¹LCMS conditions: HP1100 MSD system; Waters Xterra C18, 2 mm x 50 mm ID, 5 μM column; 10 μL injectin; Solvent A: 0.02% TFA/water; Solvent B: 0.02% TFA/acetonitrile; Gradient: Time 0: 95% A; 0.3 min: 95% A; 5 min: 10% A, Flow rate 1 mL/min; Detection: 254 nm DAD.

25

EXAMPLES 4-27Preparation of 1-(Arylsulfonyl)-3-(N-substituted-pyrrolidin-3-yl)-1H-Indole

5



Using essentially the same procedures described in Examples 3, 4 and 5 and employing the appropriate maleimide and suitable arylsulfonyl chloride the compounds shown in Table II are prepared and identified by HPLC and mass spectral analyses. (LCMS¹)

¹LCMS conditions: HP1100 MSD system; Waters Xterra C18, 2 mm x 50 mm ID, 5 uM column; 10 uL injectin; Solvent A: 0.02% TFA/water; Solvent B: 0.02% TFA/acetonitrile; Gradient: Time 0: 95% A; 0.3 min: 95% A; 5 min: 10% A, Flow rate 1 mL/min; Detection: 254 nm DAD.

20

Table II

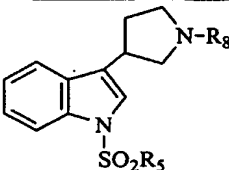
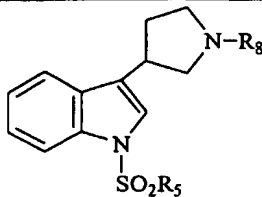
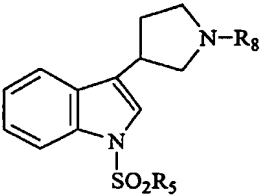
				
Ex. No.	R ₈	R ₅	M+H	LCMS (min)
4	methyl	4-fluorophenyl	359	1.78
5	methyl	4-methoxyphenyl	371	1.82

Table II (cont'd)

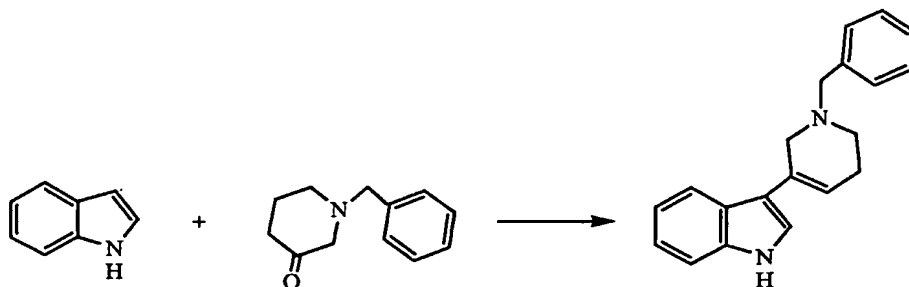


Ex. No.	R ₈	R ₅	M+H	LCMS (min)
6	methyl	4-chlorophenyl	375	1.90
7	methyl	5-chlorothien-2-yl	381	1.94
8	methyl	2-naphthyl	391	2.05
9	methyl	4-aniliny	356	1.58
10	methyl	3,4-dimethoxyphenyl	401	1.74
11	methyl	3,4-dichlorophenyl	409	2.07
12	methyl	4,5-dichlorothien-2-yl	415	2.14
13	methyl	2-bromophenyl	419	1.84
14	methyl	2-amino-4-methylthiazol-5-yl	377	1.53
15	methyl	5-chloro-3-methyl-1-benzothien-2-yl	445	2.28
16	methyl	4-iodophenyl	467	1.88
17	methyl	2-iodophenyl	467	2.00
18	benzyl	4-methylphenyl	431	2.17
19	benzyl	4-methoxyphenyl	447	2.14
20	benzyl	4-aminophenyl	432	1.68
21	benzyl	3,4-dichlorophenyl	487	2.40
22	benzyl	2-bromophenyl	495	2.15
23	benzyl	2-amino-4-methylthiazol-5-yl	453	1.60
24	benzyl	5-bromothien-2-yl	501	2.30

Table II (cont'd)

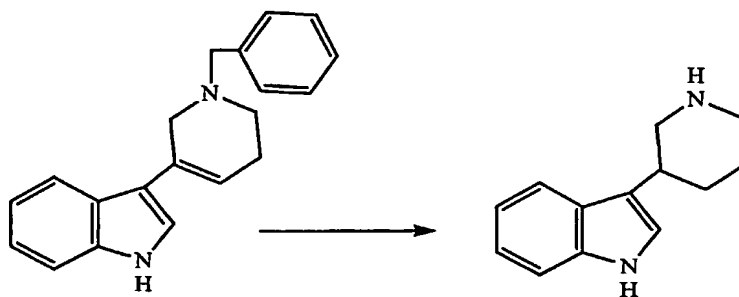
				
Ex. No.	R ₈	R ₅	M+H	LCMS (min)
26	benzyl	4-iodophenyl	543	2.21
27	benzyl	2-iodophenyl	543	2.34

5

EXAMPLE 28Preparation of 3-(1-Benzyl-1,2,5,6-tetrahydro-pyridin-3-yl)-1H-indole

10

A mixture of indole (2 g, 17 mmol) and 1-benzyl-piperidin-3-one hydrochloride hydrate (7.7 g, 34 mmol) and 2N KOH/isopropanol is heated at 80°C for 14 hours, cooled to room temperature, poured over ice/water and extracted with ethyl acetate. The extracts are combined, washed with water, dried over Na₂SO₄ and concentrated in vacuo to afford the title product, identified by HPLC and mass spectral analyses.

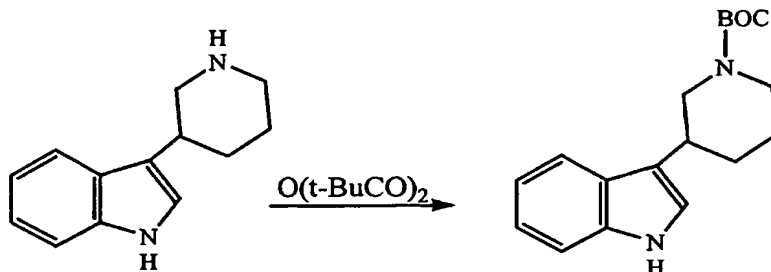
EXAMPLE 29Preparation of 3-Piperidin-3-yl-1H-indole

10 A mixture of the 3-(1-benzyl-1,2,5,6-tetrahydro-
pyridin-3-yl)-1H-indole obtained in Example 28 and 10%
palladium on carbon in a mixture of formic acid and methanol
is stirred at room temperature for 3 days and filtered
through celite. The celite is washed with methanol. The
filtrates are combined and concentrated *in vacuo* to afford
the title product, identified by HPLC and mass spectral
analyses.

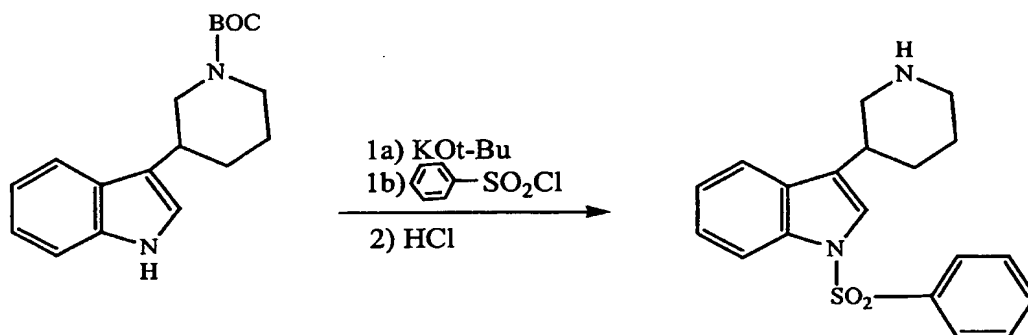
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EXAMPLE 30Preparation of 3-(1H-Indol-3-yl)-piperidine-1-carboxylic acid tert-butyl ester

5



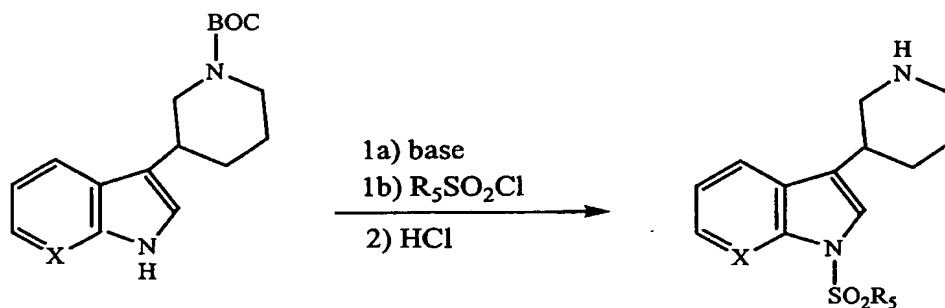
A solution of the 3-piperidin-3-yl-1H-indole obtained in Example 29 in acetone/water (1:1) at 0°C is treated with
10 di-tert-dicarbonate (4.1 g, 18.7 mmol) and K_2CO_3 (11.75 g, 85 mmol), stirred for 2 hours while warming to room temperature, and concentrated in vacuo. The resultant aqueous mixture is extracted with ethyl acetate. The extracts are combined, dried over Na_2SO_4 and concentrated in
15 vacuo. The resultant residue is purified by column chromatography (silica gel, 1% NH_4OH in $MeOH:CHCl_3$, 0:100 to 10:90 as eluent) to afford the title product, 1.25 g, identified by HPLC and mass spectral analyses.

EXAMPLE 31Preparation of 1-Benzenesulfonyl-3-piperidin-3-yl-1H-indole

5 A solution of 3-(1H-indol-3-yl)-piperidine-1-carboxylic acid tert-butyl ester (75 mg, 0.25 mmol) and phenylsulfonyl chloride (50 mg, 0.27 mmol) in tetrahydrofuran (THF) at room temperature is treated with potassium tert-butoxide (0.275 mL, 1 M solution in THF, 0.275 mmol), shaken at room temperature for 16 hours, treated with HCl (4 N in dioxane, 0.5 mL), shaken for 2 hours and concentrated *in vacuo* to give a residue. Purification of the residue by HPLC¹ affords the title product, characterized by HPLC and mass spectral analyses [M+H]⁺ 341.45, LCMS² retention time 1.67 min.

20 ¹HPLC conditions: Gilson Preparative HPLC system; YMC Pro C18, 20 mm x 50 mm ID, 5uM column; 2 mL injection; Solvent A: 0.02% TFA/water; Solvent B: 0.02% TFA/acetonitrile; Gradient: Time 0: 95% A; 2 min: 95% A; 14 min: 10% A, 15 min: 10% A, 16 min: 95% A; Flow rate 22.5 mL/min; Detection: 254 nm DAD.

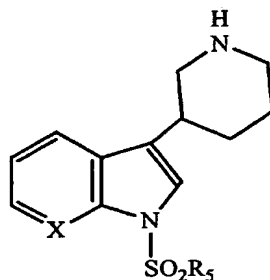
25 ²LCMS conditions: HP1100 MSD system; Waters Xterra C18, 2 mm x 50 mm ID, 5 uM column; 10 uL injection; Solvent A: 0.02% TFA/water; Solvent B: 0.02% TFA/acetonitrile; Gradient: Time 0: 95% A; 0.3 min: 95% A; 5 min: 10% A, Flow rate 1 mL/min; Detection: 254 nm DAD.

EXAMPLES 32-57Preparation of 1-Arylsulfonyl-3-piperidin-3-yl-1H-indole

Using essentially the same procedures described in Examples 28-31 and employing the appropriate indole or azaindole substrate and a suitable arylsulfonyl chloride the compounds shown in Table III are prepared and identified by HPLC and mass spectral analyses. (LCMS¹)

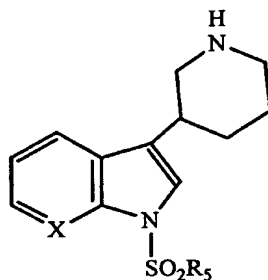
¹LCMS conditions: HP1100 MSD system; Waters Xterra C18, 2 mm x 50 mm ID, 5 uM column; 10 uL injectin; Solvent A: 0.02% TFA/water; Solvent B: 0.02% TFA/acetonitrile; Gradient: Time 0: 95% A; 0.3 min: 95% A; 3 min: 10% A, Flow rate 1 mL/min; Detection: 254 nm DAD.

Table III



Ex. No.	R5	X	M+H	LCMS (min)
32	4-isopropylphenyl	CH	384	1.95
33	5-chlorothien-2-yl	CH	382	1.83
34	3-chlorophenyl	CH	376	1.90
35	3,4-difluorophenyl	CH	377	1.79
36	4-trifluoromethoxyphenyl	CH	425	1.94
37	4-methoxyphenyl	CH	371	1.76
38	4-trifluoromethylphenyl	CH	409	1.94
39	3-chloro-4-methylphenyl	CH	390	1.96
40	2-chloro-4-trifluorophenyl	CH	444	2.02
41	2-naphthyl	CH	392	1.94
42	5-chloro-3-methylbenzo [B] - thiene-2-yl	CH	446	2.15
43	2,6-dichloro-imidazo [2,1- b]thiazol-5-yl	CH	456	1.90
44	2-Chloro-imidazo [1,2- a]pyrid-3-yl	CH	416	1.72
45	2-Chloro-benzo [d]imidazo- [2,1-b]thiazol-3-yl	CH	472	1.92
46	4-isopropylphenyl	N	385	1.95
47	5-chlorothien-2-yl	N	383	1.63
48	3-chlorophenyl	N	377	1.65

Table III (cont'd)



Ex. No.	R5	X	M+H	LCMS (min)
49	3,4-difluorophenyl	N	378	1.62
50	4-trifluoromethoxyphenyl	N	426	1.94
51	4-trifluoromethylphenyl	N	410	1.86
52	3-chloro-4-methylphenyl	N	391	1.84
53	2-chloro-4-trifluorophenyl	N	445	1.99
54	2-naphthyl	N	393	1.82
55	2,6-dichloro-imidazo[2,1-b]thiazol-5-yl	N	447	2.13
56	2-Chloro-imidazo[1,2-a]-pyrid-3-yl	N	417	1.63
57	2-Chloro-benzo[d]-imidazo[2,1-b]thiazol-3-yl	N	473	1.88

EXAMPLE 58Comparative Evaluation of 5-HT₆ Binding Affinity of Test Compounds

5

The affinity of test compounds for the serotonin 5-HT₆ receptor is evaluated in the following manner. Cultured Hela cells expressing human cloned 5-HT₆ receptors are harvested and centrifuged at low speed (1,000 x g) for 10.0 min to
10 remove the culture media. The harvested cells are suspended in half volume of fresh physiological phosphate buffered saline solution and recentrifuged at the same speed. This operation is repeated. The collected cells are then homogenized in ten volumes of 50 mM Tris.HCl (pH 7.4) and
15 0.5 mM EDTA. The homogenate is centrifuged at 40,000 x g for 30.0 min and the precipitate is collected. The obtained pellet is resuspended in 10 volumes of Tris.HCl buffer and recentrifuged at the same speed. The final pellet is suspended in a small volume of Tris.HCl buffer and the
20 tissue protein content is determined in aliquots of 10-25 μ l volumes. Bovine Serum Albumin is used as the standard in the protein determination according to the method described in Lowry et al., J. Biol. Chem., 193:265 (1951). The volume of the suspended cell membranes is adjusted to give a tissue
25 protein concentration of 1.0 mg/ml of suspension. The prepared membrane suspension (10 times concentrated) is aliquoted in 1.0 ml volumes and stored at -70° C until used in subsequent binding experiments.

Binding experiments are performed in a 96 well
30 microtiter plate format, in a total volume of 200 μ l. To each well is added the following mixture: 80.0 μ l of

incubation buffer made in 50 mM Tris.HCl buffer (pH 7.4) containing 10.0 mM MgCl₂ and 0.5 mM EDTA and 20 μ l of [³H]-LSD (S.A., 86.0 Ci/mmol, available from Amersham Life Science), 3.0 nM. The dissociation constant, K_D of the
5 [³H]LSD at the human serotonin 5-HT₆ receptor is .2.9 nM, as determined by saturation binding with increasing concentrations of [³H]LSD. The reaction is initiated by the final addition of 100.0 μ l of tissue suspension. Nonspecific binding is measured in the presence of 10.0 μ M methiothepin.
10 The test compounds are added in 20.0 μ l volume.

The reaction is allowed to proceed in the dark for 120 min at room temperature, at which time, the bound ligand-receptor complex is filtered off on a 96 well unifilter with a Packard Filtermate[®] 196 Harvester. The bound complex
15 caught on the filter disk is allowed to air dry and the radioactivity is measured in a Packard TopCount[®] equipped with six photomultiplier detectors, after the addition of 40.0 μ l Microscint[®]-20 scintillant to each shallow well. The unifilter plate is heat-sealed and counted in a
20 PackardTopCount[®] with a tritium efficiency of 31.0%.

Specific binding to the 5-HT₆ receptor is defined as the total radioactivity bound less the amount bound in the presence of 10.0 μ M unlabeled methiothepin. Binding in the presence of varying concentrations of test compound is
25 expressed as a percentage of specific binding in the absence of test compound. The results are plotted as log % bound versus log concentration of test compound. Nonlinear regression analysis of data points with a computer assisted program Prism[®] yielded both the IC₅₀ and the K_i values of
30 test compounds with 95% confidence limits. A linear

regression line of data points is plotted, from which the IC_{50} value is determined and the K_i value is determined based upon the following equation:

$$K_i = IC_{50} / (1 + L/K_D)$$

- 5 where L is the concentration of the radioactive ligand used and K_D is the dissociation constant of the ligand for the receptor, both expressed in nM.

Using this assay, the following K_i values are determined and compared to those values obtained by
10 representative compounds known to demonstrate binding to the 5-HT₆ receptor. The data are shown in Table IV, below.

Table IV	
Test Compound (Ex. No.)	5-HT ₆ Binding K_i (nM)
4	2
6	1
8	3
9	1
10	5
11	3
12	4
13	1
16	1
17	2
18	8
20	1
21	15
22	14
23	3
24	9

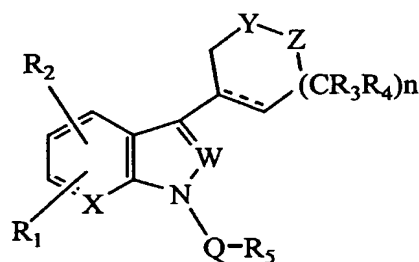
Table IV (cont'd)

Test Compound (Ex. No.)	5-HT ₆ Binding K _i (nM)
31	2
32	5
33	3
34	2
35	7
37	10
38	10
39	6
41	8
47	7
48	6
Clozapine	6.0
Loxapine	41.4
Methiothepin	8.3
Bromocriptine	23.0
Mianserin	44.2
Olanzapine	19.5

As can be seen from the data in Table II, the compounds of the invention demonstrate a high affinity for the 5-HT₆ receptor.

WHAT IS CLAIMED IS:

1. The present invention provides a compound of formula I



(I)

5

wherein

Q is SO₂, CO, CONR₂₄, CSNR₂₅ or CH₂;

W is N or CR₆;

X is N or CR₇;

10 Y is NR₈ or CR₉R₁₀;

n is 0 or an integer of 1 or 2;

Z is NR₁₁ or CR₁₂R₁₃ with the proviso that when n is 1, Q is SO₂, CO or CH₂ and W is CR₆ then Z must be CR₁₂R₁₃ and with the further provisos that when Y is NR₈ then Z must be CR₁₂R₁₃ and at least one of Y and Z must be NR₈ or NR₁₁;

15

R₁, R₂ and R₇ are each independently H, halogen, CN, OCO₂R₁₄, CO₂R₁₅, CONR₂₉R₃₀, CNR₁₆NR₁₇R₁₈, SO_mR₁₉, NR₂₀R₂₁, OR₂₂, COR₂₃ or a C₁-C₆alkyl, C₂-C₆alkenyl, C₂-C₆alkynyl, C₃-C₆cycloalkyl, cycloheteroalkyl, aryl or heteroaryl group each optionally substituted;

20

R₃, R₄, R₉, R₁₀, R₁₂ and R₁₃ are each independently H or an optionally substituted C₁-C₆alkyl group;

R₅ is an optionally substituted C₁-C₆alkyl, aryl or heteroaryl group;

25

m is 0 or an integer of 1 or 2;

R_6 is H, halogen, or an optionally substituted C_1 - C_6 alkyl, C_1 - C_6 alkoxy, aryl or heteroaryl group;
 R_8 and R_{11} are each independently H, $CNR_{26}NR_{27}R_{28}$ or a C_1 - C_6 alkyl, C_3 - C_6 cycloalkyl, cycloheteroalkyl, aryl or heteroaryl group each optionally substituted;
 R_{14} , R_{15} , R_{22} and R_{23} are each independently H or an optionally substituted C_1 - C_6 alkyl, C_2 - C_6 alkenyl, C_2 - C_6 alkynyl, C_3 - C_6 cycloalkyl, cycloheteroalkyl, aryl or heteroaryl group;
 R_{16} , R_{17} , R_{18} , R_{20} , R_{21} , R_{26} , R_{27} , R_{28} , R_{29} and R_{30} are each independently H or C_1 - C_4 alkyl;
 R_{19} is an optionally substituted C_1 - C_6 alkyl, aryl or heteroaryl group;
 R_{24} and R_{25} are each independently H or an optionally substituted C_1 - C_6 alkyl, aryl or heteroaryl group;
and
---- represents a single bond or a double bond; or the stereoisomers thereof or the pharmaceutically acceptable salts thereof.

20

2. A compound according to claim 1 wherein R_1 and R_2 are independently selected from hydrogen, halogen, C_1 - C_6 alkyl, C_1 - C_6 alkoxy, hydroxy and cyano

25

3. A compound according to claim 1 or claim 2 wherein R_3 and R_4 when present are independently hydrogen and (C_1 - C_6)alkyl.

30

4. A compound according to any one of claims 1 to 3 wherein Y is NR_8 or CR_9R_{10} where R_8 , R_9 and R_{10} are each selected from hydrogen, C_1 - C_6 alkyl and C_1 - C_6 alkyl substituted by aryl.

5. A compound according to any one of claims 1 to 4
wherein Z is NR_{11} or $\text{CR}_{12}\text{R}_{13}$ where R_{11} , R_{12} and R_{13} are each
5 selected from hydrogen, $\text{C}_1\text{-C}_6$ alkyl and $\text{C}_1\text{-C}_6$ alkyl substituted
by aryl.

6. A compound according to any one of claims 1 to 5
wherein Q is SO_2 .

10

7. A compound according to any one of claims 1 to 6
wherein R_5 is aryl or heteroaryl

8. A compound according to claim 7 wherein R_5 is a
15 group selected from phenyl, naphthyl, thienyl, thiazolyl,
benzothienyl; quinolyl; imidazo[1,2-a]pyridinyl,
imidazo[2,1-b]thiazolyl and benzo[d]imidazo[2,1-b]thiazolyl;
said groups being unsubstituted or optionally substituted by
one to three substituents the same or selected from nitro,
20 cyano, thiocyanato, cyanato, hydroxyl, alkyl of 1-6 carbon
atoms, halo($\text{C}_1\text{-C}_6$)alkyl, ($\text{C}_1\text{-C}_6$)alkoxy, halo($\text{C}_1\text{-C}_6$)alkoxy,
amino, ($\text{C}_1\text{-C}_6$)alkylamino, di-($\text{C}_1\text{-C}_6$ alkyl)amino, formyl, ($\text{C}_1\text{-C}_6$
alkoxy)carbonyl, carboxyl, ($\text{C}_1\text{-C}_6$)alkanoyl, ($\text{C}_1\text{-C}_6$)alkylthio,
($\text{C}_1\text{-C}_6$)alkylsulphinyl, ($\text{C}_1\text{-C}_6$)alkyl-sulphonyl,
25 carbamoyl, ($\text{C}_1\text{-C}_6$)alkylamido, phenyl, phenoxy, benzyl,
benzyloxy, heteroaryl and cycloheteroalkyl or ($\text{C}_3\text{-C}_8$)cycloalkyl groups

9. A compound according to any one of claims 1 to 8
30 wherein W is CR_6 wherein R_6 is hydrogen or ($\text{C}_1\text{-C}_6$)alkyl or W
is N.

10. A compound according to any one of claims 1 to 9 wherein X is CR₇ wherein R₇ is hydrogen.

5

11. A compound according to any one of claims 1 to 10 wherein ---- represents a single bond.

10

12. The compound according to claim 1 selected from the group consisting of:

1- (phenylsulfonyl) -3- (piperidin-4-yl) -1H-indazole;

1- (4-nitrophenyl) -3- (piperidin-4-yl) -1H-indazole;

1- (4-fluorophenyl) -3- (piperidin-4-yl) -1H-indazole;

15

1- (3,4-dimethoxyphenyl) -3- (piperidin-4-yl) -1H-indazole;

1- (4-fluorophenylsulfonyl) -3- (1-methyl-pyrrolidin-3-yl) -1H-indole;

1- (4-chlorophenylsulfonyl) -3- (1-methylpyrrolidin-3-yl) -1H-indole;

20

1- (naphth-2-ylsulfonyl) -3- (1-methylpyrrolidin-3-yl) -1H-indole;

1- (4-aminophenylsulfonyl) -3- (1-methylpyrrolidin-3-yl) -1H-indole;

25

1- (3,4-dimethoxyphenylsulfonyl) -3- (1-methylpyrrolidin-3-yl) -1H-indole;

1- (3,4-dichlorophenylsulfonyl) -3- (1-methylpyrrolidin-3-yl) -1H-indole;

1- [(4,5-dichlorothien-2-yl) sulfonyl] -3- (1-methyl-pyrrolidin-3-yl) -1H-indole;

30

1- (2-bromophenylsulfonyl) -3- (1-methylpyrrolidin-3-yl) -1H-indole;

- 1- (4-iodophenylsulfonyl) -3- (1-methylpyrrolidin-3-yl) -1H-indole;
- 1- (2-iodophenylsulfonyl) -3- (1-methylpyrrolidin-3-yl) -1H-indole;
- 5 1- (4-aminophenylsulfonyl) -3- (1-benzylpyrrolidin-3-yl) -1H-indole;
- 3- (1-benzylpyrrolidin-3-yl) -1- (4-methylphenylsulfonyl) -1H-indole;
- 3- (1-benzylpyrrolidin-3-yl) -1- (3,4-dichlorophenyl-sulfonyl) -1H-indole;
- 10 3- (1-benzylpyrrolidin-3-yl) -1- (2-bromophenylsulfonyl) -1H-indole;
- 5- [3- (1-benzylpyrrolidin-3-yl) -indole-1-sulfonyl] -4-methylthiazol-2-ylamine;
- 15 3- (1-benzylpyrrolidin-3-yl) -1- [(5-bromothien-2-yl) sulfonyl] -1H-indole;
- 1-phenylsulfonyl-3- (1-methylpyrrolidin-3-yl) -1H-pyrrolo[2,3-b]pyridine;
- 1-phenylsulfonyl-3- (1-methylpyrrolidin-3-yl) -1H-indazole;
- 20 1-phenylsulfonyl-3- (1-methyl-2,5-dihydro-1H-pyrrol-3-yl) -1H-pyrrolo[2,3-b]pyridine;
- 1-phenylsulfonyl-3- (1-methyl-2,5-dihydro-1H-pyrrol-3-yl) -1H-indole;
- 1-phenylsulfonyl-3- (1-methylpiperidin-4-yl) -1H-indazole;
- 25 1-phenylsulfonyl-3- (1-methyl-1,2,3,6-tetrahydropyridin-4-yl) -1H-indazole;
- 1-phenylsulfonyl-3- (1-methylazepan-4-yl) -1H-pyrrolo[2,3-b]pyridine;
- 1-phenylsulfonyl-3- (1-methylazepan-4-yl) -1H-indole;
- 30 1-phenylsulfonyl-5-fluoro-3- (1-methylazepan-4-yl) -1H-indole;

- 1-phenylsulfonyl-3-(1-methyl-2,3,6,7-tetrahydro-1H-azepin-4-yl)-1H-indole;
1-phenylsulfonyl-3-(1-methyl-2,5,6,7-tetrahydro-1H-azepin-4-yl)-1H-indole;
5 1-phenylsulfonyl-3-(1-methyl-2,3,6,7-tetrahydro-1H-azepin-4-yl)-1H-pyrrolo[2,3-b]pyridine;
1-phenylsulfonyl-5-fluoro-3-(1-methyl-2,3,6,7-tetrahydro-1H-azepin-4-yl)-1H-indole;
1-phenylsulfonyl-5-fluoro-3-(1-methyl-2,5,6,7-tetrahydro-1H-azepin-4-yl)-1H-indole;
10 1-(benzo[b]thien-4-ylsulfonyl)-3-(1-methyl-pyrrolidin-3-yl)-1H-pyrrolo[2,3-b]pyridine;
1-(3-fluorophenylsulfonyl)-3-(1-methylpyrrolidin-3-yl)-1H-indazole;
15 1-(2,5-dichlorophenylsulfonyl)-3-(2,5-dihydro-1H-pyrrol-3-yl)-1H-pyrrolo[2,3-b]pyridine;
8-[3-(1-methyl-2,5-dihydro-1H-pyrrol-3-yl)indole-1-sulfonyl]-quinoline;
1-phenylsulfonyl-5-chloro-3-(1-methylpiperidin-4-yl)-1H-indazole;
20 5-methoxy-3-(1-methyl-1,2,3,6-tetrahydropyridin-4-yl)-1-(naphth-1-yl-sulfonyl)-1H-indazole;
3-(1-methylazepan-4-yl)-1-(naphth-1-yl-sulfonyl)-1H-pyrrolo[2,3-b]pyridine;
25 3-(1-methylazepan-4-yl)-1-(naphth-1-yl-sulfonyl)-1H-indole;
1-(benzo[b]thien-4-ylsulfonyl)-5-fluoro-3-(1-methylazepan-4-yl)-1H-indole;
8-[3-(1-methyl-2,3,6,7-tetrahydro-1H-azepin-4-yl)-indole-1-sulfonyl]-quinoline;
30 3-(1-methyl-2,5,6,7-tetrahydro-1H-azepin-4-yl)-1-(naphth-1-ylsulfonyl)-1H-indole;

- 8- [3- (1-methyl-2,3,6,7-tetrahydro-1H-azepin-4-yl) -
pyrrolo[2,3-b]pyridine-1-sulfonyl]-quinoline;
8- [5-fluoro-3- (1-methyl-2,3,6,7-tetrahydro-1H-azepin-4-yl) -
indole-1-sulfonyl]-quinoline;
5 5-fluoro-3- (1-methyl-2,5,6,7-tetrahydro-1H-azepin-4-yl) -1-
(naphth-1-ylsulfonyl) -1H-indole;
1- (benzo[b]thien-4-ylsulfonyl) -3- (1-benzyl-pyrrolidin-3-yl) -
1H-pyrrolo[2,3-b]pyridine;
1- (3-fluoro-phenylsulfonyl) -3- (1-phenethyl-pyrrolidin-3-yl) -
10 1H-indazole;
1- (2,5-dichlorophenylsulfonyl) -3- (1-ethyl-2,5-dihydro-1H-
pyrrol-3-yl) -1H-pyrrolo[2,3-b]pyridine;
3- (1-methyl-2,5-dihydro-1H-pyrrol-3-yl) -1- (naphth-2-
ylsulfonyl) -1H-indole;
15 5-chloro-1- (3-fluorophenylsulfonyl) -3-piperidin-4-yl-1H-
indazole;
5-methoxy-1- (naphth-1-ylsulfonyl) -3- (1,2,2-trimethyl-
1,2,3,6-tetrahydro-pyridin-4-yl) -1H-indazole;
1- (naphth-1-ylsulfonyl) -3- (1-phenethyl-azepan-4-yl) -1H-
20 pyrrolo[2,3-b]pyridine;
3-azepan-4-yl-1- (naphth-1-ylsulfonyl) -1H-indole;
3-azepan-4-yl-1- (3-chloro-5-methyl-benzo[b]thien-2-
ylsulfonyl) -5-fluoro-1H-indole;
8- [3- (1-phenethyl-2,3,6,7-tetrahydro-1H-azepin-4-yl) -indole-
25 1-sulfonyl]-quinoline;
3- [1- (3,3-dimethylbutyl) -2,5,6,7-tetrahydro-1H-azepin-4-yl] -
1- (naphth-2-ylsulfonyl) -1H-indole;
1- (2,3-dichlorophenylsulfonyl) -3- (1-methyl-2,3,6,7-
tetrahydro-1H-azepin-4-yl) -1H-pyrrolo[2,3-]pyridine;
30 1- [(3-chloro-5-methoxyphenylsulfonyl)] -3- (2,2-dimethyl-
2,3,6,7-tetrahydro-1H-azepin-4-yl) -5-fluoro-1H-indole;

- 3-azepan-4-yl-5-fluoro-1-(naphth-2-ylsulfonyl)-1H-indole;
1-Benzenesulfonyl-3-piperidin-3-yl-1H-indole;
1-(4-isopropyl-benzenesulfonyl)-3-piperidin-3-yl-1H-indole;
1-(5-chloro-thiophene-2-sulfonyl)-3-piperidin-3-yl-1H-
5 indole;
1-(3-chloro-benzenesulfonyl)-3-piperidin-3-yl-1H-indole;
1-(3,4-difluoro-benzenesulfonyl)-3-piperidin-3-yl-1H-indole;
1-(4-trifluoromethoxy-benzenesulfonyl)-3-piperidin-3-yl-1H-
indole;
10 1-(4-methoxy-benzenesulfonyl)-3-piperidin-3-yl-1H-indole;
1-(4-trifluoromethy-benzenesulfonyl)-3-piperidin-3-yl-1H-
indole;
1-(3-chloro-4-methyl-benzenesulfonyl)-3-piperidin-3-yl-1H-
indole;
15 1-(2-chloro-4-trifluoromethyl-benzenesulfonyl)-3-piperidin-
3-yl-1H-indole;
1-(2-naphthylenesulfonyl)-3-piperidin-3-yl-1H-indole;
1-(5-chloro-3-methyl-benzo[b]thiophene-2-sulfonyl)-3-
piperidin-3-yl-1H-indole;
20 1-(2,6-dichloro-imidazo[2,1-b]thiazole-5-sulfonyl)-3-
piperidin-3-yl-1H-indole;
2-chloro-3-(3-piperidin-3-yl-indole-1-sulfonyl)-imidazo[1,2-
a]pyridine;
2-chloro-3-(3-piperidin-3-yl-indole-1-sulfonyl)-
25 benzo[d]imidazo[2,1-b]thiazole;
1-(4-isopropyl-benzenesulfonyl)-3-piperidin-3-yl-1H-
pyrrolo[2,3-b]pyridine;
1-(5-chloro-thiophene-2-sulfonyl)-3-piperidin-3-yl-1H-
pyrrolo[2,3-b]pyridine;
30 1-(3-chloro-benzenesulfonyl)-3-piperidin-3-yl-1H-
pyrrolo[2,3-b]pyridine;

- 1- (3,4-difluoro -benzenesulfonyl) -3-piperidin-3-yl-1H-
pyrrolo[2,3-b]pyridine;
1- (4-trifluoromethoxy-benzenesulfonyl) -3-piperidin-3-yl-1H-
pyrrolo[2,3-b]pyridine;
5 1- (3-chloro-4-methyl-benzenesulfonyl) -3-piperidin-3-yl-1H-
pyrrolo[2,3-b]pyridine;
1- (2-chloro-4-trifluoromethyl-benzenesulfonyl) -3-piperidin-
3-yl-1H-pyrrolo[2,3-b]pyridine;
1- (2-naphthylenesulfonyl) -3- piperidin-3-yl-1H-pyrrolo[2,3-
10 b]pyridine;
1- (5-chloro-3-methyl-benzo[b]thiophene-2-sulfonyl) -3-
piperidin-3-yl-1H-pyrrolo[2,3-b]pyridine;
2-chloro-3- (3-piperidin-3-yl-pyrrolo[2,3-b]pyridine-1-
sulfonyl) -imidazo[1,2-a]pyridine;
15 2-chloro-3- (3-piperidin-3-yl-pyrrolo[2,3-b]pyridine-1-
sulfonyl) -benzo[d]imidazo[2,1-b]thiazole;
and the pharmaceutically acceptable salts thereof.

- 20 13. A method for the treatment of a disorder of the
central nervous system related to or affected by the 5-HT₆
receptor in a patient in need thereof which comprises
providing said patient with a therapeutically effective
amount of a compound of formula I or the stereoisomers
25 thereof or the pharmaceutically acceptable salts thereof as
defined in any one of claims 1 to 12.

14. A method according to claim 13 wherein said
30 disorder is a mood disorder, a motor disorder, or a
cognitive disorder.

15. A method according to claim 13 wherein said disorder is schizophrenia.

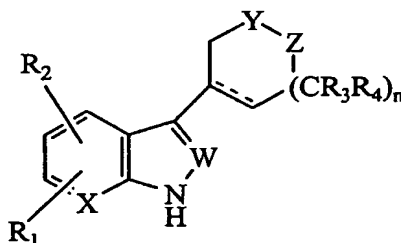
5 16. A method according to claim 13 wherein said disorder is anxiety or depression.

17. A method according to claim 13 wherein said disorder is memory loss or attention deficit disorder.
10

18. A pharmaceutical composition which comprises a pharmaceutically acceptable carrier and a compound of formula I or a stereoisomer thereof or a pharmaceutically acceptable salt thereof as claimed in any one of claims 1 to 12.
15

19. A process for preparing a compound of formula (I) as claimed in claim 1 which process comprises one of the following:
20

a) reacting a compound of formula



25

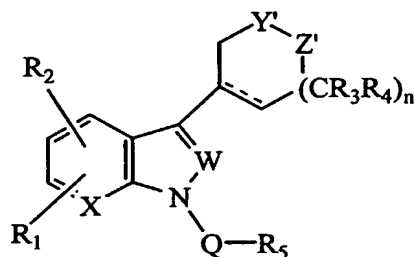
wherein W, X, Y, Z, R₁, R₂, R₃ and R₄ are as defined herein,
with an appropriate sulfonylating, acylating,
carbamoylating, thiocarbamoylating or alkylating agent
containing the group:

5 R_5-Q-

where R₈ is as defined above and Q is SO₂, CO, CONR₂₄, CSNR₂₅
or CH₂ ; said reactants protected on reactive sites and/or
on reactive substituent groups as required, and removing any
protecting groups to give a corresponding compound of
10 formula (I);

or

b) removing a protecting group from a compound of formula



15

wherein Q, W, X, R₁, R₂, R₃, R₄ and R₅ are as defined herein
and one of Y' and Z' is N-G where G is a protecting group
and the other is CR₉R₁₀ or CR₁₂R₁₃ as appropriate to give a
compound of formula (I) wherein Y or Z is NH;

20

or

c) alkylating a compound of formula (I) as defined in
above wherein R₈ or R₁₁ is hydrogen with an alkylating agent
of formula R₈-L or R₁₁-L wherein L is a leaving group, such
25 as halogen, and R₈ and R₁₁ are each as defined in herein

excepting hydrogen, to give a corresponding compound of formula (I);

or

- 5 d) converting a compound of formula (I) having a reactive substituent group to a different compound of formula I;

or

- 10 e) converting a basic compound of formula (I) to an acid addition salt or vice versa.

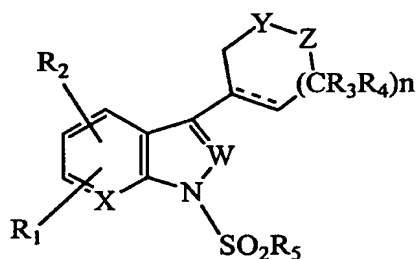
or

- f) isolating an isomer of a compound of formula (I) from a mixture of isomers.

15

20. A process for the preparation of a compound of formula If

20



(If)

wherein

W is N or CR₆;

X is N or CR₇;

- 25 Y is NR₈ or CR₉R₁₀;

n is 0 or an integer of 1 or 2;

Z is NR_{11} or $\text{CR}_{12}\text{R}_{13}$ with the proviso that when n is 1 and W is CR_6 then Z must be $\text{CR}_{12}\text{R}_{13}$ and with the further provisos that when Y is NR_8 then Z must be $\text{CR}_{12}\text{R}_{13}$ and at least one of Y and Z must be NR_8 or NR_{11} ;

R_1 , R_2 and R_7 are each independently H, halogen, CN, $\text{OCO}_2\text{R}_{14}$, CO_2R_{15} , $\text{CONR}_{29}\text{R}_{30}$, $\text{CONR}_{29}\text{R}_{30}$, $\text{CNR}_{16}\text{NR}_{17}\text{R}_{18}$, SO_mR_{19} , $\text{NR}_{20}\text{R}_{21}$, OR_{22} , COR_{23} or a C_1 - C_6 alkyl, C_2 - C_6 alkenyl, C_2 - C_6 alkynyl, C_3 - C_6 cycloalkyl, cycloheteroalkyl, aryl or heteroaryl group each optionally substituted;

R_3 , R_4 , R_9 , R_{10} , R_{12} and R_{13} are each independently H or an optionally substituted C_1 - C_6 alkyl group;

R_5 is an optionally substituted C_1 - C_6 alkyl, aryl or heteroaryl group;

m is 0 or an integer of 1 or 2;

R_6 is H, halogen, or an optionally substituted C_1 - C_6 alkyl, C_1 - C_6 alkoxy, aryl or heteroaryl group;

R_8 and R_{11} are each independently H, $\text{CNR}_{26}\text{NR}_{27}\text{R}_{28}$ or a C_1 - C_6 alkyl, C_3 - C_6 cycloalkyl, cycloheteroalkyl, aryl or heteroaryl group each optionally substituted;

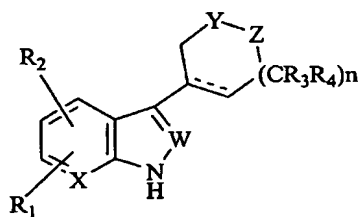
R_{14} , R_{15} , R_{22} and R_{23} are each independently H or an optionally substituted C_1 - C_6 alkyl, C_2 - C_6 alkenyl, C_2 - C_6 alkynyl, C_3 - C_6 cycloalkyl, cycloheteroalkyl, aryl or heteroaryl group;

R_{16} , R_{17} , R_{18} , R_{20} , R_{21} , R_{26} , R_{27} , R_{28} , R_{29} and R_{30} are each independently H or C_1 - C_4 alkyl;

R_{19} is an optionally substituted C_1 - C_6 alkyl, aryl or heteroaryl group; and

---- represents a single bond or a double bond

which process comprises reacting a compound of formula IVa



(IVa)

wherein W, X, Y, Z, n, R₁, R₂, R₃ and R₄ are as defined above
with a sulfonyl chloride, R₅SO₂Cl, wherein R₅ is defined
5 above in the presence of a base.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
4 July 2002 (04.07.2002)

PCT

(10) International Publication Number
WO 02/051837 A3

(51) International Patent Classification⁷: C07D 403/04,
401/04, 471/04, A61P 25/00, A61K 31/435, 31/44, 31/40
// (C07D 403/04, 209:00, 207:00) (C07D 401/04, 211:00,
209:00) (C07D 471/04, 223:00, 209:00)

(21) International Application Number: PCT/US01/47935

(22) International Filing Date:
11 December 2001 (11.12.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/257,627 22 December 2000 (22.12.2000) US

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(74) Agents: BERG, Egon, E. et al.; Wyeth, Patent Law Department, Five Giralda Farms, Madison, NJ 07940 (US).

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZM, ZW.

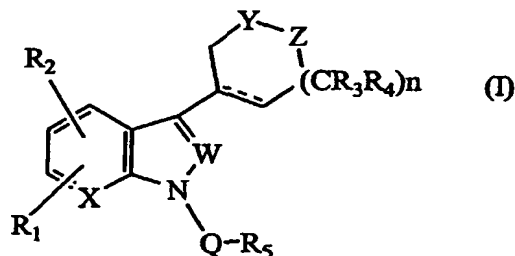
(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— with international search report

(88) Date of publication of the international search report:
16 January 2003

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: HETEROCYCLINDAZOLE AND AZAINDAZOLE COMPOUNDS AS 5-HYDROXYTRYPTAMINE-6 LIGANDS



(57) Abstract: The present invention provides a compound of formula (I) and the use thereof in the therapeutic treatment of disorders related to or affected by the 5-HT₆ receptor.

WO 02/051837 A3

INTERNATIONAL SEARCH REPORT

International Application No.
PCT/US 01/47935

A. CLASSIFICATION OF SUBJECT MATTER IPC 7 C07D403/04 C07D401/04 C07D471/04 A61P25/00 A61K31/435 A61K31/44 A61K31/40 //(C07D403/04, 209:00, 207:00), (C07D401/04, 211:00, 209:00), (C07D471/04, 223:00, 209:00) According to International Patent Classification (IPC) or to both national classification and IPC											
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) IPC 7 C07D A61K Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practical, search terms used) EPO-Internal, CHEM ABS Data											
C. DOCUMENTS CONSIDERED TO BE RELEVANT <table border="1"> <thead> <tr> <th>Category *</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>WO 98 23587 A (ALLELIX BIOPHARMA) 4 June 1998 (1998-06-04) page 3, line 14 - line 15; claim 1; examples 18A, 23 ---</td> <td>1, 3-5, 7-11, 18</td> </tr> <tr> <td>X</td> <td>ZHENG Q ET AL : "Palladium catalyzed cross-coupling reaction between 3-indole boronic acids and tetrahydropyridine triflates" TETRAHEDRON LETTERS ELSEVIER SCIENCE PUBLISHERS AMSTERDAM NL, vol. 34, no. 14, 1993, pages 2235-2238, XP001085184 examples 8-11 --- -/--</td> <td>1-10</td> </tr> </tbody> </table>			Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X	WO 98 23587 A (ALLELIX BIOPHARMA) 4 June 1998 (1998-06-04) page 3, line 14 - line 15; claim 1; examples 18A, 23 ---	1, 3-5, 7-11, 18	X	ZHENG Q ET AL : "Palladium catalyzed cross-coupling reaction between 3-indole boronic acids and tetrahydropyridine triflates" TETRAHEDRON LETTERS ELSEVIER SCIENCE PUBLISHERS AMSTERDAM NL, vol. 34, no. 14, 1993, pages 2235-2238, XP001085184 examples 8-11 --- -/--	1-10
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<input checked="" type="checkbox"/> Further documents are listed in the continuation of box C. <input checked="" type="checkbox"/> Patent family members are listed in annex.											
* Special categories of cited documents : <table border="0"> <tr> <td> *A* document defining the general state of the art which is not considered to be of particular relevance *E* earlier document but published on or after the international filing date *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) *O* document referring to an oral disclosure, use, exhibition or other means *P* document published prior to the international filing date but later than the priority date claimed </td> <td> *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. *&* document member of the same patent family </td> </tr> </table>			*A* document defining the general state of the art which is not considered to be of particular relevance *E* earlier document but published on or after the international filing date *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) *O* document referring to an oral disclosure, use, exhibition or other means *P* document published prior to the international filing date but later than the priority date claimed	*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. *&* document member of the same patent family							
A document defining the general state of the art which is not considered to be of particular relevance *E* earlier document but published on or after the international filing date *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) *O* document referring to an oral disclosure, use, exhibition or other means *P* document published prior to the international filing date but later than the priority date claimed	*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. *&* document member of the same patent family										
Date of the actual completion of the international search 2 July 2002		Date of mailing of the international search report 21/08/2002									
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016		Authorized officer Bakboord, J									

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 01/47935

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	ZHENG Q ET AL: "Vinylolation of the indole 3-position via palladium-catalyzed cross-coupling" HETEROCYCLES, vol. 37, no. 3, 1994, page 1761-1772 XP002204320 JP examples 10-13	1-10
X	SCHUT R N ET AL : "2-Tetrahydropyridylindoles as Histamine and Serotonin Antagonists" JOURNAL OF MEDICINAL CHEMISTRY, vol. 13, no. 3, 1970, page 394-397 XP002204321 USA example 9	1-5,7-10
X	BUSACCA C A ET AL: "A Facile Synthesis of 4-Aryl-2,3-Dihydropyrroles" TETRAHEDRON LETTERS, ELSEVIER SCIENCE PUBLISHERS, AMSTERDAM, NL, vol. 37, no. 23, 3 June 1996 (1996-06-03), pages 3947-3950, XP004029267 ISSN: 0040-4039 examples 8-11	1-10
X	WO 00 63203 A (ALLELIX BIOPHARMA) 26 October 2000 (2000-10-26) claim 1	1
A	SLEIGHT ET AL: "The 5-hydroxytryptamine-6 receptor: localisation and function" EXPERT OPINION ON THERAPEUTIC PATENTS, ASHLEY PUBLICATIONS, GB, vol. 8, no. 10, 1 October 1998 (1998-10-01), pages 1217-1224, XP002093843 ISSN: 1354-3776 the whole document	1

INTERNATIONAL SEARCH REPORT

national application No.
PCT/US 01/47935

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☒ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

Although claims 13-17 are directed to a method of treatment of the human/animal body, the search has been carried out and based on the alleged effects of the compounds.
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT
 information on patent family members

International Application No
 PCT/US 01/47935

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 9823587	A	04-06-1998	AU 738668 B2	20-09-2001
			AU 5112298 A	22-06-1998
			WO 9823587 A1	04-06-1998
			CN 1245491 A	23-02-2000
			EP 0944595 A1	29-09-1999
			JP 2001504501 T	03-04-2001
			TW 432059 B	01-05-2001
			ZA 9710643 A	02-09-1998
WO 0063203	A	26-10-2000	WO 0063203 A1	26-10-2000
			AU 3403599 A	02-11-2000
			EP 1173432 A1	23-01-2002